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NICHOLS NEW GRADED LESSONS IN ARITHMETIC

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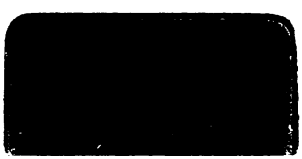
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NEW GRADED LESSONS

IN

ARITHMETIC

BOOK VII

BY

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NEW HAVEN, CONN.

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PREFACE

THIS seventh book of the series follows the same general plan as the preceding books. The first few pages are devoted to a systematic review of the work of the preceding grade. Then the new work for the year is taken up and that is followed by a general summary. This arrangement is shown in the table of contents.

In the advanced work of the grade especial emphasis is given to the applications of percentage, including bank discount, commercial discount, insurance, commission, taxes, etc. Great care has been taken to present these topics in a clear and simple manner so that the pupils may be able to understand them, without the help of the teacher.

The aim has been to present a large variety of reasonable problems that appeal to the pupils as coming within the range of their experiences.

Several lessons are given that bear especially upon the work in manual training, thus connecting that important branch with the regular work of the schoolroom. For the same reason a few lessons are given in home furnishing and in domestic economy.

The oral work, because of its importance, is emphasized here as it has been in the earlier books of the series.

The work in algebra has been extended and the pupils are introduced for the first time to the simplest principles of constructive geometry.

In preparing the manuscript the author acknowledges his indebtedness to many teachers for suggestions, but especially to Mr. Lincoln W. Barnes, instructor in manual training in the Eaton District, for the lessons connected with his department, to Robert W. Elliott, Principal Group U, Baltimore, Md., and to Miss Mabel E. Bemis, Instructor, Prince School, Boston, Massachusetts, for reading the manuscript and suggesting improvements.

WILBUR F. NICHOLS.

NEW HAVEN, May, 1910.

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NEW GRADED LESSONS IN ARITHMETIC

Book VII

Lesson 1. *ORAL REVIEW*

Add :

1.	2.	3.	4.	5.
6	26	17	19	76
7	47	48	24	85

6. What is addition?

7. What is the sign of addition? What is it called?

Add rapidly by columns and by lines :

	8.	9.	10.	11.	12.	13.	14.	15.
16.	7 +	4 +	6 +	5 +	3 +	8 +	2 +	8
17.	6 +	8 +	9 +	0 +	9 +	6 +	8 +	11
18.	8 +	9 +	4 +	3 +	8 +	4 +	7 +	6
19.	4 +	6 +	1 +	9 +	4 +	2 +	9 +	14
20.	1 +	7 +	4 +	5 +	2 +	9 +	6 +	18
21.	8 +	3 +	2 +	7 +	6 +	7 +	3 +	7
22.	3 +	0 +	7 +	6 +	7 +	0 +	5 +	3
23.	5 +	8 +	9 +	8 +	4 +	5 +	1 +	16

24. Count by 7's from 0 to 84.

25. In the same way count by 3's, 5's, 8's, 9's.

1. What is subtraction?
2. What is the sign of subtraction? What is it called?
3. What are the terms of subtraction called?
4. What is the result of subtraction called?
5. 17 − 8 = 9. In this example name each term.
6. 32 In examples like this *think* 32 − 7 = 25, 25 − 17 10 = 15, but *say* simply 32, 25, 15.

Subtract :

7. 41	8. 74	9. 53	10. 65	11. 72
26	39	17	27	36

12. How do you prove an example in subtraction?
13. By what process do you find the difference between two numbers?

Find the difference between the following numbers :

14. 526	15. 715	16. 829	17. 304	18. 482
200	400	700	100	200
19. 196	20. 212	21. 130	22. 215	23. 152
78	96	45	79	89

In the following examples make change when the value of the purchase and money offered is given :

24. $ .42	$1.00	25. $ .87	$2.00
26. $ .65	$5.00	27. $ .13	$1.00
28. $1.15	$2.00	29. $2.45	$10.00

30. What number added to 17 gives 32?
31. Count backward by 7's from 86 to 2.
32. Count backward by 5's from 59 to 4.
33. What number subtracted from 32 gives 15?
34. In the last example name the subtrahend. Name the minuend. Name the difference.

You are supposed to be familiar with the reading and writing of numbers.

1. Name the ten figures, called digits, used in the Arabic system of notation.

2. Why do we call this system a *decimal* system?

3. What is numeration?

4. On what does the value of any figure depend?

5. What change is made in the value of a figure if it is moved one place to the left? One place to the right?

6. In the number 4236, for what does the 6 stand? For what does the 3 stand? The 2? The 4?

7. Name the first four periods in order.

8. You will seldom use a larger number, yet it may be well to learn the names of the higher periods, viz.: trillions, quadrillions, quintillions, sextillions, septillions, octillions, nonillions, decillions.

9. In a number like 26.3, what do we call the period (.)?

Read the following numbers:

10. 1,401.00405
11. 2,501,072,010.0004
12. 760.010402
13. 36,105,140,715.00412
14. 78.000107
15. 11,101,000,010.000702

16. Notice the similarity of sound when reading the following:

101,000, one hundred one thousand.
.101, one hundred one thousandths.
100.001, one hundred *and* one thousandth.

Write the following in figures :

17. Two thousand two and two thousandths.
18. Two hundred thousand and two hundred-thousandths.
19. Two thousand and two thousandths.
20. Two hundred two thousandths.
21. Two hundred and two thousandths.
22. Two million, two thousand two and two thousandths.

1. *a*. $6 \times 7 = 42$. *b*. 8 ft. $\times$ 9 = 72 ft. Of what is $\times$ the sign? How is it read in *a*? How is it read in *b*?

2. What is multiplication?

3. What is the name of the number that is to be repeated or multiplied?

4. What is the name of the number by which we multiply?

5. What is the result of multiplication called?

6. In example 1, state the multiplicand and multiplier in each case.

7. What is an abstract number? A concrete number?

8. Which term in multiplication must always be an abstract number?

Give products :

9.	10.	11.	12.	13.
48	32	71	50	60
2	5	6	6	5

14. State the rule for multiplying any number by 10. By 100. By 1000.

Multiply the following :

15.	16.	17.	18.	19.
79	86	35	72	86
10	10	10	100	100
20.	**21.**	**22.**	**23.**	**24.**
70	30	80	90	70
60	50	70	60	30

25. How do you prove an example in multiplication?

26. State a rule for multiplying a number by 50. Multiply each of the following by 50: 12; 204; 72; 86.

27. State a rule for multiplying a number by 25. Multiply each of the following by 25: 36; 24; 404; 16.

28. State a rule for multiplying by $33\frac{1}{3}$. Multiply each of the following by $33\frac{1}{3}$; 9; 27; 15; 360.

In 1908 the appropriations for the different departments in a certain city were as follows:

Education	$600,181.00	Public Works	$253,794.00
Police	224,140.00	Fire	199,525.00
Charities	92,690.00	Lighting	80,923.00
Parks	28,000.00	Health	26,350.00
Library	19,500.00	Assessors	11,580.00
Collector	8,780.00	Town Clerk	9,080.00
Corporation Counsel	6,300.00	Registrar	5,990.00
Board of Relief	900.00	Interest	166,010.26
Sinking Fund	100,000.00	Miscellaneous	190,437.35

1. Find the total amount of the appropriations.

2. How much more was allowed for education than for police and fire protection?

3. How much more was appropriated for public works than for the interest on the debt?

4. How much less was appropriated for lighting than for charities?

5. How much more did the park commissioners receive than the board of health?

AREAS AND POPULATION OF STATES

States	Area in square miles	Population, 1900
Maine	33,040	694,466
New Hampshire	9,305	411,588
Vermont	9,565	343,641
Massachusetts	8,315	2,805,346
Rhode Island	1,250	428,556
Connecticut	4,990	908,420
New York	49,170	7,268,894
New Jersey	7,815	1,883,699
Maryland	12,219	1,188,044

6. Find the total area and total population of these states.

7. How much larger is the population of New York than the total population of the New England States?

8. Make 10 examples for the class to solve based on these statistics.

1. Name the terms used in division.

2. What is division?

3. Make an example in division, the quotient of which must be an abstract number. A concrete number.

4. The dividend is 27 and the divisor 9. Express this example in three ways.

5. What is the sign of division?

6. The divisor is 3 and the dividend is 15 ft. Express this example using the sign. Read the example as you have written it.

Divide :

7. $3\overline{)27}$ 8. $5\overline{)200}$ 9. $7\overline{)84}$ 10. $9\overline{)270}$

11. $7\overline{)140}$ 12. $8\overline{)640}$ 13. $5\overline{)525}$ 14. $4\overline{)484}$

15. How do you divide a number by 10? By 100? By 1000? By 2000? By 500?

16. Divide the following by 100: *a.* 675; *b.* 106; *c.* 281.

17. Divide the following by 1000: *a.* 2461; *b.* 1074; *c.* 8635; *d.* 3807.

18. Divide the following by 2000: *a.* 8400; *b.* 6200; *c.* 8000; *d.* 12,600.

19. Divide the following by 50: *a.* 200; *b.* 450; *c.* 500.

20. State the quickest way of finding how many articles can be bought for a given amount at 25¢ each. At 50¢ each. At 20¢. At $33\frac{1}{3}$¢.

21. At 20¢ each, how many articles can be bought for \$10? For \$15? \$4? \$21? \$100?

22. At 50¢ each, how many articles can be bought for \$3? \$2.50? \$6? \$4.50? \$75? \$250?

23. At $33\frac{1}{3}$¢ each, how many articles can be bought for \$1? \$7? \$20? \$60? \$110? \$320?

24. At 25¢ each, how many articles can be bought for \$4? \$1.50? \$2.25? \$8? \$10? \$40?

1. A grocer paid \$1,148.40 for flour at \$4.35 a barrel. If he sold it at \$5.15 a barrel, how much did he gain?

2. The area of Porto Rico is 3606 sq. mi. and the population is 953,243. Find to the nearest unit the population of each square mile.

3. Porto Rico exports annually \$14,867,000 worth of goods. Find to the nearest dollar the amount of exports for each person.

4. The area of France is 207,054 sq. mi. and the value of her exports is \$1,119,400,000. Find to the nearest dollar the value of the exports for each square mile.

A realty company issues the following statements:

Assets		Liabilities	
Real Estate	\$784,187.25	Bond Accounts	\$233,896.63
Office Equipment	5,083.46	Profit Sharing Bonds	62,335.00
Loans	5,923.65	Bonds	5,865.00
Sundry Accounts	14,583.11	Real Estate	213,850.00
Cash	14,144.57	Sundry Accounts	2,212.07
		Capital Stock	100,000.00

5. Find the value of the assets. Find the value of the liabilities.

6. Subtract the liabilities from the assets to find the profits.

7. Two automobiles start from two towns 105 miles apart and travel toward each other. They meet in 3 hours. If the first traveled 15 miles an hour, how many miles did the second travel an hour?

8. A dealer sold 96 yd. of carpeting at \$1.87$\frac{1}{2}$ a yard. If he gained \$38.40, how much did it cost him a yard?

9. How many farms containing 90 acres each can be formed in a town that is in the form of a rectangle 6 miles long and 4$\frac{1}{2}$ miles wide? There are 640 acres in a square mile.

10. If 63 is added to a certain number, it will contain forty-two 246 times. What is the number?

1. Name two numbers that multiplied together give 15 as their product.

2. Name then the two factors of 15.

3. What is a factor?

4. What are the factors of 35? 21? 12? 42?

5. Of the following numbers name those that can be exactly divided by other numbers: 7; 14; 11; 20; 19; 27.

6. What are composite numbers? Prime numbers?

46	39	213	459	365	780
51	68	171	234	315	928

7. Which of these numbers are divisible by 2? By 3? By 5? By 9?

8. Name the prime numbers between 1 and 50.

9. Name the composite numbers between 1 and 50.

10. Name all the numbers that can be exactly divided by 2 between 0 and 20.

11. A number that can be exactly divided by 2 is called an —— number.

12. Name all the odd numbers between 1 and 25.

13. Name two numbers that are both odd and prime.

14. Name 5 numbers that are both odd and composite.

15. Name 5 numbers that are both even and composite.

16. Name the factors of 15. Name the factors of 25. What factor is common to both, that is, is found in both numbers?

17. Name a common factor or divisor of 12 and 20.

18. What is the greatest common divisor of 12 and 20?

19. Name some numbers that are divisible by 3. By 5.

20. Name a number that is divisible by both 3 and 5, that is, name a common multiple of 3 and 5.

21. Name a common multiple of 4 and 10.

22. Name a common multiple of 2, 3, and 5.

The greatest common divisor or **measure** of two or more numbers is the greatest number that exactly divides each of the numbers.

What is the greatest common divisor of 18, 30, and 48?

2)18–30–48
3)9–15–24
3– 5– 8
$2 \times 3 = 6$

Arrange the numbers as indicated. Divide by 2, the smallest common prime factor. The quotients are 9, 15, and 24. Divide these by 3, the smallest common prime factor. The quotients are 3, 5, and 8, which have no common factor. The greatest common divisor is the product of the prime factors, 2 and 3.

Find the greatest common divisor of:

1. 16, 20, 24.	**2.** 48, 60, 72.	**3.** 24, 60, 96.
4. 14, 21, 49.	**5.** 32, 48, 96.	**6.** 18, 36, 72.
7. 32, 48, 64.	**8.** 15, 35, 85.	**9.** 50, 125, 375.

Find the greatest common measure of 1001 and 1144.

1001)1144(1
1001
Ans. 143)1001(7
1001

The greatest common divisor of numbers not easily factored will seldom be required. If necessary this method may be used: Divide the larger number by the smaller. Divide the divisor by the remainder, and continue till there is no remainder. The last divisor will be the greatest common divisor.

In the following examples find the greatest common divisor of the numerator and denominator and divide each term by it to reduce the fraction to its lowest terms:

10. $\frac{212}{371}$	**11.** $\frac{435}{522}$	**12.** $\frac{155}{279}$	**13.** $\frac{164}{205}$	**14.** $\frac{672}{784}$	**15.** $\frac{275}{625}$
16. $\frac{202}{303}$	**17.** $\frac{850}{935}$	**18.** $\frac{104}{156}$	**19.** $\frac{144}{156}$	**20.** $\frac{819}{936}$	**21.** $\frac{300}{825}$
22. $\frac{96}{108}$	**23.** $\frac{325}{750}$	**24.** $\frac{475}{625}$	**25.** $\frac{105}{120}$	**26.** $\frac{512}{728}$	**27.** $\frac{144}{180}$
28. $\frac{1056}{1584}$	**29.** $\frac{1440}{1728}$	**30.** $\frac{1136}{3088}$	**31.** $\frac{1278}{3474}$	**32.** $\frac{2688}{3072}$	**33.** $\frac{375}{1000}$

Find the least common multiple of 12, 20, and 30.

2)12–20–30
2)6–10–15
3)3– 5–15
5)1– 5– 5
1– 1– 1
$2 \times 2 \times 3 \times 5 = 60$

A common multiple of two or more numbers contains *all the factors* of each of the numbers. Arrange the numbers as indicated. Divide by any prime number that will divide one or more. When a number is not divisible write it in the line below without change. Continue to divide till the quotients are unity. The product of all the divisors will be the least common multiple.

Find the least common multiple of :

1. 30, 48, 60.
2. 8, 16, 30.
3. 40, 56, 60.
4. 42, 58, 84.
5. 18, 22, 24.
6. 15, 27, 35.
7. 35, 42, 70.
8. 27, 36, 45.
9. 36, 45, 90.

In the following change to common denominators by finding the least common multiple of the denominators :

Add :

10. $\frac{7}{15}, \frac{5}{18}$
11. $\frac{4}{15}, \frac{5}{21}$
12. $\frac{11}{30}, \frac{51}{80}$
13. $\frac{31}{48}, \frac{21}{32}$
14. $\frac{27}{84}, \frac{17}{132}$
15. $\frac{17}{24}, \frac{35}{36}$

16. What is the smallest quantity of apples that can be exactly measured by the 2 quart, 4 quart, and 8 quart measure?

17. Find the least number of marbles that can be equally divided among 6, 9, or 12 boys.

18. What is the smallest distance that can be exactly measured by a 2 foot, 3 foot, and 8 foot measure?

19. What is the smallest number of yards of cloth that can be exactly cut into 7 yd. lengths, 5 yd. lengths, or 3 yd. lengths.

20. Two forces are pulling a weight upward. If one force lifts $16\frac{3}{4}$ lb. and the other force $12\frac{15}{16}$ lb., what is the weight of the object?

You have studied fractions so long that you should be familiar with all the definitions and processes. Therefore explanations are omitted from this book.

1. What is a fraction?

2. Tell the meaning of $\frac{2}{3}$, $\frac{3}{5}$, $\frac{5}{7}$, $\frac{7}{9}$.

3. Which term of the fraction gives the size of the parts and therefore names the fraction?

4. Which term of the fraction numbers the parts?

a. $\frac{3}{4}$	*b.* $\frac{7}{8}$	*c.* $2\frac{1}{2}$	*d.* $\frac{7}{6}$	*e.* $4\frac{1}{3}$	*f.* $\frac{5}{6}$
g. $\frac{12}{4}$	*h.* $12\frac{1}{5}$	*i.* $\frac{1}{2}$	*j.* $7\frac{1}{4}$	*k.* $\frac{11}{5}$	*l.* $7\frac{1}{6}$

5. Of these fractions name the improper fractions. What is an improper fraction?

6. Apply the definition of a fraction to $\frac{4}{3}$, and state why it might be called an incorrect fraction.

7. What is a mixed number? In the list above name the mixed numbers.

8. What do you mean by reduction of fractions?

9. Change $\frac{6}{12}$ to halves. What principle is illustrated when fractions are reduced to their lowest terms?

10. Change $\frac{2}{3}$ to ninths. What principle of fractions is illustrated when fractions are changed to higher terms?

11. What method did you learn in Lesson 9 for reducing a fraction to its lowest terms?

Reduce to lowest terms:

12. $\frac{8}{12}$	**13.** $\frac{18}{24}$	**14.** $\frac{21}{35}$	**15.** $\frac{14}{28}$	**16.** $\frac{15}{25}$

Reduce to 24ths :

17. $\frac{2}{3}$	**18.** $\frac{1}{2}$	**19.** $\frac{3}{4}$	**20.** $\frac{5}{6}$	**21.** $\frac{7}{8}$

22. How do you change a mixed number to an improper fraction?

Change to improper fractions :

23. $3\frac{1}{2}$	**24.** $4\frac{1}{4}$	**25.** $5\frac{1}{5}$	**26.** $6\frac{1}{6}$	**27.** $7\frac{1}{7}$

1. What are similar fractions?

2. Add, *a*. $4\frac{5}{7}$, $7\frac{2}{3}$, $5\frac{4}{5}$. *b*. $1\frac{7}{8}$, $2\frac{3}{4}$, $4\frac{7}{12}$, $5\frac{1}{6}$.

3. Explain addition of fractions, and give the reasons for every step.

4. The three sides of a triangle are $5\frac{2}{3}$ inches, $3\frac{1}{2}$ inches and $6\frac{3}{16}$ inches. What is the perimeter?

5. From $56\frac{1}{3}$ take $17\frac{7}{12}$.

6. What number must be subtracted from $126\frac{1}{4}$ to leave $37\frac{7}{8}$?

7. A man spent $\frac{1}{4}$ of his income for rent, $\frac{3}{8}$ for food, and $\frac{3}{16}$ for clothing. What part of his income did he spend? What part of his income was left?

8. How do you multiply an integer by a fraction?

9. At \$16 a ton, how much will $9\frac{3}{4}$ tons of hay cost?

10. State the method of multiplying a fraction by an integer.

11. Find the perimeter of a square that measures $15\frac{7}{12}$ ft.

12. What is cancelation?

13. How do you multiply a fraction by a fraction?

Using cancelation find the product of :

14. $\frac{7}{8} \times \frac{32}{35}$ 15. $\frac{5}{16} \times \frac{48}{55}$ 16. $\frac{11}{12} \times \frac{3}{5}$

17. $27\frac{1}{3} \times 33\frac{2}{3}$ 18. $6\frac{1}{2} \times 24\frac{1}{3}$ 19. $12\frac{2}{9} \times 27\frac{1}{8}$

20. Find the cost of $15\frac{1}{2}$ tons of hay at \$$18\frac{3}{4}$ a ton.

21. If a bird can fly $9\frac{1}{4}$ miles in $\frac{1}{3}$ of an hour, how far can it fly in $1\frac{1}{2}$ hours?

22. Find $\frac{1}{4}\frac{9}{2}$ of 5208. Find $\frac{2}{3}\frac{6}{7}$ of 444.

23. A garden is $15\frac{2}{3}$ yd. long and $9\frac{5}{6}$ yd. wide. How many square yards are there in the area of the garden?

24. A strong wind giving a pressure of $14\frac{1}{2}$ lb. per square foot blows squarely against the end of a building 24 ft. wide and $18\frac{1}{2}$ ft. high. What is the total wind pressure against the end of the building?

1. State the rule for dividing a fraction by an integer.

2. Divide: *a.* $3\frac{3}{4}$ by 9. *b.* $156\frac{3}{16}$ by 3.

3. State a rule for dividing an integer by a fraction.

4. If $3\frac{1}{3}$ yd. of cloth cost \$10, what will $2\frac{2}{3}$ yd. cost?

5. What is a complex fraction? Write one. Change it to a simple fraction.

6. Show the effect upon the value of a fraction by:

a. Multiplying its numerator by 2.
b. Dividing its denominator by 2.
c. Multiplying both numerator and denominator by 2.
d. Dividing both numerator and denominator by 2.
e. Multiplying its numerator by 2 and dividing its denominator by 2.
f. Dividing its numerator by 2 and multiplying its denominator by 2.

7. Simplify: *a.* $\frac{37\frac{1}{2}}{150}$ *b.* $\frac{37\frac{1}{2}}{6\frac{1}{4}}$ *c.* $\frac{\frac{3}{8}}{5\frac{1}{4}}$

8. If $15\frac{3}{4}$ bbl. of flour cost \$63, what will $10\frac{1}{2}$ bbl. cost?

Statement:

$\$\not{6}\overset{3}{\not{3}} \times \frac{\overset{2}{\not{4}}}{\not{6}\overset{3}{\not{3}}} \times \frac{21}{\not{2}} = \$\text{——}$

Make statements of all processes to be used in the solution of problems like this and shorten the work by cancelation. If $15\frac{3}{4}$ bbl. cost \$63, 1 bbl. will cost $\$63 \div 15\frac{3}{4} = \frac{4}{63}$ of \$63, and $10\frac{1}{2}$ bbl. will cost $\frac{21}{2} \times \frac{4}{63} \times \$63$.

9. If $13\frac{3}{4}$ cd. of wood cost \$96, what will $5\frac{1}{2}$ cd. cost?

10. What part of 14 is 7? Of 360 is 144?

11. In finding what part one number is of another, which number do you place as the numerator and which one as the denominator?

12. A man starts on an automobile journey of $87\frac{1}{2}$ miles. What part of the distance has the automobile gone when it has traveled $17\frac{1}{2}$ miles?

13. In a mass of ore weighing $32\frac{1}{4}$ pounds, $21\frac{1}{2}$ pounds are pure copper. What part of the whole mass is copper?

1. Read, 300.03; 5,000.005; 7.2.

2. Read the following as *a*, mixed decimals. *b*, as thousandths: 2.007; 26.027; 250.305.

3. Name the decimal places in order from tenths to billionths.

4. How do you multiply a decimal by 10? By 100?

5. How do you divide a decimal by 10? By 1000?

6. Prefixing a cipher to a decimal has what effect upon the value of the decimal? Why?

7. How should decimals be arranged for convenience in adding or subtracting?

8. Add 2.2; 1.01; 3.21.

9. From 4.4 take 3.21.

10. How do the number of decimal places in the product compare with the number in both multiplicand and multiplier?

Multiply:

11. 25 by .1	12. 2.5 by .1	13. .25 by .1
14. 15 by .01	15. 1.5 by .01	16. .15 by .01

17. In dividing a decimal by a decimal what change should you first make in the position of the decimal points?

18. Can you tell why changing the position of the points as you have indicated does not change the value of the quotient?

19. Divide 2.5 by .5. After changing the points how does this example read?

Divide :

20. .12 by .4	22. 1.2 by .4	24. .012 by .4
21. 2.4 by .6	23. .24 by .06	25. .024 by .06

26. A unit consists of how many hundredths? State this question in another form.

27. How many thousandths make a tenth?

1. Divide 9.936 by .46.

$$
\begin{array}{r}
21.6 \\
46\overline{)993.6} \\
92 \\
\hline
73 \\
46 \\
\hline
276 \\
276 \\
\hline
\end{array}
$$

Before dividing change the divisor to an integer by moving the decimal points in both dividend and divisor as many places as there are decimal figures in the divisor. Place the decimal point in the quotient directly above the point in the dividend.

Find the *specific gravity* of the following substances by dividing the weight of a cubic foot as given by 62.5 lb., the weight of a cubic foot of water. Carry answer to thousandths.

2. Glass, 175.8 lb.
3. Maple Wood, 46.886 lb.
4. Silver, 655.1 lb.
5. Brick, 118.3 lb.
6. Brass, 523.8 lb.
7. Cork, 15 lb.

8. What will 16.375 casks of wine cost, if 8.1875 casks cost $982.50?

9. Divide 234.61875 by $16\frac{1}{8}$.

10. If .75 of a yard of cloth cost $2.40, how many yards can be bought for $38.40?

11. The sum of two numbers is $127\frac{7}{8}$, and the smaller number is 49.125. Find the greater number.

12. If a man can build .425 of a rod of fence in an hour, how many rods can 12 men build in 6.5 days, working 8.25 hours a day?

13. If .35 of a cargo of 8,000 bu. of wheat were burned, what was the value of the part left at $.875 a bushel?

14. Add: twenty-six and fifteen thousandths; eighty-one thousand nine hundred ten-thousandths; eleven and twenty thousand seven hundred four hundred-millionths; twelve hundred and twelve hundred-thousandths.

1. How do you find the area of a rectangle?

2. How many square inches are there on the surface of a 6-in. cube?

3. How many 4-in. squares can be cut from a 20-in. square?

4. If the area of a rectangular field is 77 sq. rd., and the base is 11 rods, what is the altitude?

5. How many square rods are there in a field 80 rd. long and 40 rd. wide? How many acres are there?

6. How many cubic feet are there in a cord of wood?

7. What are the dimensions of a cord of wood?

8. A pile of wood is 32 ft. long, 4 ft. high, and 4 ft. wide. Find the number of cords in the pile without finding the number of cubic feet.

9. A block of granite is 4 ft. long, 3 ft. wide, and 2.5 ft. thick. How many cubic feet does it contain?

10. At \$1.25 a cubic foot find the cost of the granite block in the eleventh example.

11. How many square yards are there in a ceiling 18 ft. by 24 ft? At 20¢ a square yard, find the cost of painting the ceiling.

12. How many cubic feet are there in a rectangular block 2 ft. square at the end and 6 ft. long?

13. How many times larger would a block be that was twice as long, twice as wide, and twice as thick?

14. How many blocks $\frac{1}{4}$ of an inch on a side can be sawed from a 2-in. cube?

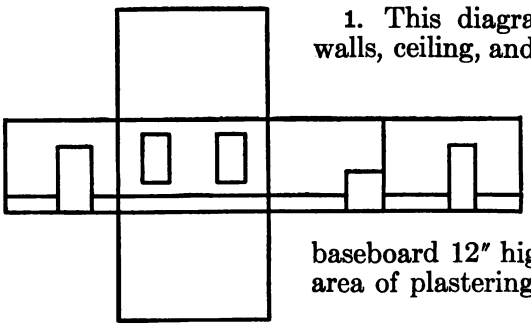
15. How many square rods are there in a rectangular garden, 8 rd. long and 5 rd. wide?

16. What is this garden worth at \$2$\frac{1}{2}$ a square rod?

17. What will it cost to fence this garden at \$1.25 a rod?

18. Give the area of a rectangle measuring 7$\frac{1}{2}$ inches by 6 inches.

In estimating the cost of painting or plastering in most places it is the custom to deduct from the total area one half of the area of the openings. Since this rule varies, you should be guided by the custom observed in your locality.



1. This diagram represents the walls, ceiling, and floor; 16′ long 12′ wide, 9′ high. There are 2 doors, each 4′ by 7′; 2 windows, each 4′ by 6′; a fireplace 5′ by 5′, and a baseboard 12″ high. Find the total area of plastering.

$2 \times (16' + 12') = 56'$ perimeter.
56 sq. ft. $\times$ 9 = 504 sq. ft. in walls.
16 sq. ft. $\times$ 12 = 192 sq. ft. in ceiling.
504 sq. ft. + 192 sq. ft. = 696 sq. ft. total area.
$2 \times$ (7 sq. ft. $\times$ 4) = 56 sq. ft. in doors.
$2 \times$ (6 sq. ft. $\times$ 4) = 48 sq. ft. in windows.
5 sq. ft. $\times$ 5 = 25 sq. ft. in fireplace.
$56 \text{ ft.} - (4' + 4' + 5') = 43'$ length of baseboard.
43 sq. ft. $\times$ 1 = 43 sq. ft. in baseboard.
$\frac{1}{2}$ (56 + 48 + 25) + 43 sq. ft. = $107\frac{1}{2}$ sq. ft. to be deducted. 696 sq. ft. − $107\frac{1}{2}$ sq. ft. = $588\frac{1}{2}$ sq. ft. of plastering.

2. At 20¢ a square yard find the cost of plastering a room 20′ long, 17′ wide, and 12′ high. There are 4 doors each 7′ by $4\frac{1}{2}$′, 3 windows each 6′ by $4\frac{1}{2}$′, and a baseboard 8 in. high.

3. A room is 18′ by 24′ by 9′. There are 2 doors 4′ by $7\frac{1}{2}$′, 2 windows, 4′ by 6′, and a baseboard 9 in. high. Find the cost at 22¢ a square yard of plastering the room.

4. Find the cost at 2¢ a square yard of kalsomining the walls and ceiling of a room 16′ by 15′ by 10′, when no allowance is made for openings.

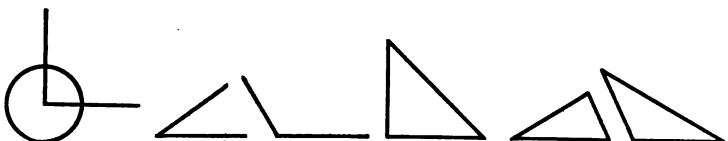


Fig. 1. Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig 6

1. How many degrees are there in a circle?

2. What part of the whole circle does it take to measure the angle in Fig. 1?

3. Then Fig. 1 is an angle of how many degrees?

4. It is also called a **right angle.**

5. An **angle** is the difference in direction of two straight lines that meet or would meet if produced.

6. An **acute angle** is an angle smaller than a right angle. Which figure is an acute angle?

7. An **obtuse angle** is an angle greater than a right angle. Which figure is an obtuse angle?

8. A **triangle** is a plane figure bounded by three straight lines.

9. Triangles are named from their largest angles, as **acute triangle, right triangle,** and **obtuse triangle.** Name the triangles at the top of the page.

10. Angles are measured by means of a protractor, which is half a circle, whose circumference is marked off into degrees.

11. Cut from cardboard a protractor and use it in measuring all the angles on this page.

TABLE OF ANGLES AND CIRCLES

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)
360 degrees = 1 circumference

12. Any part of the circumference of a circle is an **arc.** One quarter of the circumference is a **quadrant.**

1. Triangles are also named from their sides as, equilateral, isosceles, and scalene.

2. An **equilateral** triangle has 3 equal sides.
An **isosceles** triangle has 2 equal sides.
A **scalene** triangle has none of its sides equal.

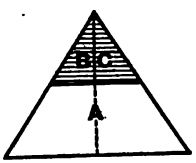


Fig. 1

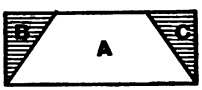
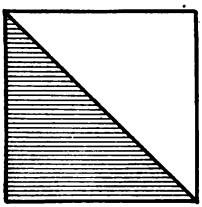


Fig. 2


Fig. 3

3. The **base** of a triangle is the side upon which it rests.

4. The **vertex** is the angle opposite the base.

5. The **altitude** is the perpendicular distance from the base, or the base produced, to the vertex.

6. From Fig. 3, can you see that the area of a triangle is equal to $\frac{1}{2}$ the area of a rectangle having the same dimensions?

7. From Fig. 1 and 2, can you see that the area of a triangle is equal to the area of a rectangle having the same base and $\frac{1}{2}$ of the altitude?

Learn: The area of a triangle is equal to half the area of a rectangle having the same base and altitude.

Find the area of triangles with the following bases and altitudes:

8. 36 ft., 24 ft.
9. 2′ 6″, 3′.
10. 17 yd., 15 yd.
11. 3 yd. 1 ft., 4 ft.
12. 19 rd., 13 rd.
13. 7 ft. 8 in., 5 ft. 2 in.

14. State a rule for finding the base when the area and altitude are given, also for finding the altitude when the area and base are given.

1. A plane figure bounded by straight lines is a **polygon,** meaning *many angles.*

2. A quadrilateral is a polygon of 4 sides.

3. You will seldom use any polygon except the triangle and quadrilateral. It may be well to know that a figure of 5 sides is a **pentagon**; of 6 sides, a **hexagon**; of 8 sides, an **octagon**; of 9 sides, a **nonagon**; of 10 sides, a **decagon.**

4. The quadrilaterals are:

The **square**, having 4 right angles and 4 equal sides.

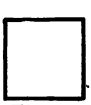
The **oblong**, having 4 right angles, and opposite sides equal. Squares and oblongs are also called **rectangles.**

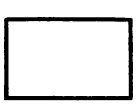
The **rhombus**, having no right angles, but all its sides equal.

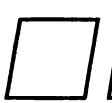
The **rhomboid**, having no right angles, and only opposite sides equal.

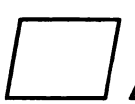
The **trapezoid**, having only two of its opposite sides parallel.

The **trapezium**, having none of its sides parallel.


Fig. 1.


Fig. 2


Fig. 3


Fig. 4

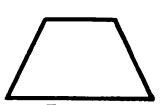

Fig. 5


Fig. 6

5. Name each of these figures.

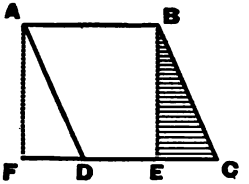
6. State the rule for finding the area of a rectangle.

7. State the rule for finding one dimension when the area and the other dimension are given.

8. What will be the cost of paving and curbing a street $\frac{3}{4}$ of a mile long and 42 ft. wide, if the paving costs \$1.25 a square yard, and the curbing costs 45¢ a linear foot?

9. A house is 32 ft. long and its rafters are 15 ft. long. Find the total weight of snow on this roof, if the weight on each square foot is 17 lb.

10. Measure the size of all the windows and find the amount of lighting surface in the room.



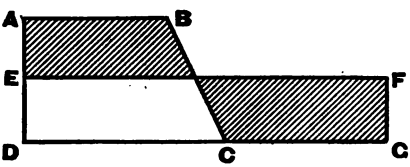
1. In this figure ABCD is a rhombus. If we cut off the shaded part BEC and place it on the other side it will cover the part marked AFD. We now have the figure ABEF.

2. What is the name of the figure ABEF? How do you find its area?

3. Compare the base and altitude of the rhombus ABCD with the base of the square, ABEF.

4. Do you see that the area of a rhombus is equal to that of a rectangle having the same base and altitude?

5. Make a drawing and see if the same rule is true of a rhomboid.



6. Give the name of the figure ABCD.

7. Cut out of paper a trapezoid four times as large as this figure.

8. Fold so that the two parallel edges will coincide. Crease and cut on the crease. Place the two pieces so that what were the two parallel sides shall form one continuous side. See EFGD. What form have you now?

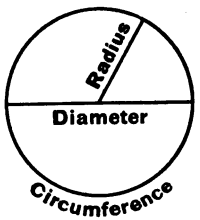
9. The base of this rectangle is the sum of what two sides of the trapezoid?

10. The altitude of the rectangle is what part of the altitude of the trapezoid?

Learn: To find the area of a trapezoid multiply the sum of the two parallel sides by $\frac{1}{2}$ of the altitude.

Find the area of trapezoids of the following dimensions:

	Altitude	Parallel Sides		Altitude	Parallel Sides
11.	60 ft.	11 ft., 16 ft.	12.	40 ft.	60 ft., 130 ft.
13.	6 ft.	13 ft., $6\frac{1}{2}$ ft.	14.	86 in.	120 in., 96 in.
15.	16 yd.	25 yd., 21 yd.	16.	$4\frac{1}{2}$ in.	25 in., 20 in.



1. The line that bounds this circle is called its ——.

2. The straight line that passes through the center touching both sides is the ——.

3. What is the radius?

4. The circumference of every circle is how many times its diameter?

5. This ratio is usually expressed by the Greek letter π (pi). $\pi = 3.1416$.

6. How do you find the circumference when you know the diameter?

7. How do you find the diameter when you know the circumference?

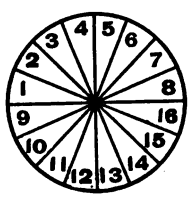


Fig. 1

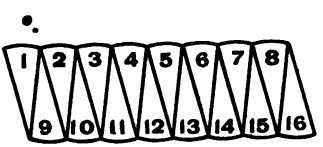


Fig. 2

8. Cut out of paper a circle whose diameter is about 6 in. Cut it into 16 parts as shown in Fig. 1.

9. Arrange the parts as shown in Fig. 2. Is the area of Fig. 2 the same as that of Fig. 1?

10. What is approximately the shape of Fig. 2? How do you find its area?

Learn: To find the area of a circle multiply one half of the circumference by the radius.

11. What dimensions of a circle do you need to know to find its area? If only one dimension is given how do you find the other?

Find the area of a circle when the:

12. Diameter is 17.5 ft.
13. Radius is $4\frac{1}{4}$ ft.
14. Circumference is 50 in.
15. Circumference is 5 ft. 4 in.
16. Radius is 20 rd.
17. Diameter is 28 ft.

1. All kinds of lumber are measured by board feet.

2. According to size and use pieces of lumber are called boards, planks, scantlings, joists, plates, girders, beams, etc.

3. A *board foot* is equivalent to a square piece of board 1′ long, 1′ wide, and 1″ thick. Boards less than 1″ in thickness are reckoned as one inch.

4. Find the number of board feet in a plank 18′ by 9′ by 3″.

$18' \times \frac{9}{12} \times 3 = \text{——}$.

If the plank was 1″ thick, each foot in length would contain $\frac{9}{12}$ of a board foot. Then 18′ would contain $18 \times \frac{9}{12}$; and since it is 3″ thick it will contain $(18 \times \frac{9}{12} \times 3)$ board feet. Use cancelation.

NOTE: — When boards are 1 in. thick the number of board feet in a board is the same as the square feet of one side.

5. How many feet of lumber are required for a tight board fence 140 ft. long and $5\frac{1}{3}$ ft. high?

6. If each plank is 2 in. thick, how many feet of lumber will be needed for a floor 12′ by 16′?

7. One end of a barn measures 40 ft. in width and 20 ft. to the eaves, and the altitude of the gable is 15 ft. How many feet of lumber will cover this end?

8. If each side of the roof measures 80 ft. by $25\frac{1}{2}$ ft., find the number of feet of boards that will cover the roof.

9. If the floor is covered with 3-in. planks find the cost of the floor at $18 per M.

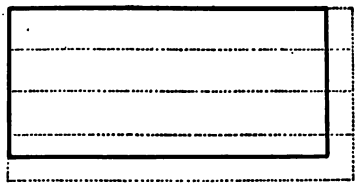
10. Find the cost of 15 joists, each 20′ × 9″ × 6″, at $1.85 per C.

11. How many board feet are there in 8 sticks of timber 18′ × 10″ × 12″?

12. At $16.73 per M, find the cost of 35 planks, each 24′ × 16″ × 3″.

13. How many boards 12 ft. long will it take to enclose a square field 48 rd. on a side, with a fence 5 boards high?

14. If each board is 6 in. wide, find the cost of the boards at $15 per M.



1. This diagram represents a room 18 ft. long, $10\frac{1}{2}$ ft. wide. How many breadths of carpeting 1 yard wide will be needed? How long will each breadth be if there is a loss of 6 in. on each breadth for matching? How many yards of carpet will it take for the room?

$10\frac{1}{2}$ ft. $\div$ 3 ft. $= 3\frac{1}{2}$ $\therefore$ 4 breadths.
18 ft. + 6 in. $= 18\frac{1}{2}$ ft. $= 6\frac{1}{6}$ yd. length.
$6\frac{1}{6}$ yd. $\times$ 4 $= 24\frac{2}{3}$ yd.

Since breadths of carpet are not split, it will be necessary to buy 4 breadths. Each breadth will be 6 in. longer than the room or $18\frac{1}{2}$ ft. long.

Learn: Divide the width of the room by the width of the carpet to find the number of breadths when the carpet runs lengthwise. Add the loss in matching to the length of the room, to find the length of each breadth. Multiply the length of each breadth by the number of breadths to find the amount of carpet needed.

2. How would you find the number of breadths needed when the carpet runs widthwise?

3. A room is 18 ft. by 24 ft. The carpet is $\frac{3}{4}$ of a yard wide and runs lengthwise. If there is a waste of 9 in. on each breadth for matching, how many yards of carpet will it take for the room? At \$1.25 a yard, find the cost of the carpet.

When the breadths run lengthwise, find the cost of carpeting from the following data:

	Room	Width of Carpet	Loss in Matching	Price a Yard
4.	12′ × 16′	1 yd.	8 in.	\$ .75
5.	15′ × 17′	$\frac{3}{4}$ yd.	9 in.	.65
6.	16′ × 21′	1 yd.	none	1.25
7.	18′ × 24′	27 in.	1 ft.	.85
8.	16′ × 19′	1 yd.	6 in.	.90
9.	17′ × 21′	$2\frac{1}{4}$ ft.	$\frac{1}{2}$ yd.	1.10

1. American wall paper is usually $1\frac{1}{2}$ ft. wide and 24 ft. long for a single roll and 48 ft. long for a double roll. A fraction of a roll is not sold and unless otherwise stated the price of a single roll is given. It is not easy to estimate exactly the amount of paper needed for a room, especially since paper hangers do not always use the same rule.

The following rule is sufficiently accurate for all purposes: Find the number of feet in the perimeter of the room, leaving out the widths of the doors and windows. Divide by $1\frac{1}{2}$ feet (the width of the paper), to find the number of strips required. Divide the length of a roll by the height of the room, to find the number of strips in a roll. Divide the strips needed for the room by the strips in a roll, to find the rolls required. In the first and third divisions, if there is a fraction take the next higher integer; in the second division take the next lower integer.

2. A hall is 18 ft. by $6\frac{1}{2}$ ft. and $7\frac{1}{2}$ ft. high. There is one door and one window, each $3\frac{1}{2}$ feet wide. At 24¢ a roll, find the cost of the paper.

$2\ (18\text{ ft.} + 6\frac{1}{2}\text{ ft.}) = 49\text{ ft. perimeter.}$
$49\text{ ft.} - (3\frac{1}{2}\text{ ft.} + 3\frac{1}{2}\text{ ft.}) = 42\text{ ft.}$
$42\text{ ft.} \div 1\frac{1}{2}\text{ ft.} = 28.$ No. of strips for room.
$24\text{ ft.} \div 7\frac{1}{2}\text{ ft.} = 3\frac{1}{5}\ \therefore 3$ strips in a roll.
$28\text{ strips} \div 3\text{ strips} = 9\frac{1}{3}\ \therefore 10$ rolls for room.
$24¢ \times 10 = \$2.40.$

NOTE — When the ceiling is to be papered find the quantity needed in the same way that you would find the amount of carpet needed for the floor.

Find the cost of papering, including the ceiling:

	Rooms	Doors	Windows	Cost per Roll
3.	$20' \times 15' \times 9'$	$2, 4' \times 7'$	$2, 3\frac{1}{2}' \times 6'$	20¢
4.	$16' \times 12' \times 8'$	$1, 4' \times 6\frac{1}{2}'$	$2, 3' \times 6'$	28¢
5.	$15' \times 11' \times 8\frac{1}{2}'$	$3, 4' \times 7'$	$2, 3' \times 5\frac{1}{2}'$	30¢
6.	$30' \times 24' \times 12'$	$5, 4\frac{1}{2}' \times 7'$	$4, 3\frac{1}{2}' \times 6'$	24¢
7.	$18' \times 21' \times 10'$	$4, 4' \times 7\frac{1}{2}'$	$3, 3' \times 5\frac{1}{2}'$	18¢
8.	$16' \times 14' \times 9\frac{1}{2}'$	$3, 4\frac{1}{2}' \times 7'$	$2, 3\frac{1}{2}' \times 6'$	30¢

1. If 6 bbl. of flour cost \$33, what will 11 bbl. cost?

2. If 2 bu. of cider apples cost 40 cents, what will 3 pk. cost?

3. What will 5 pints of molasses cost at \$.80 a gallon?

4. What is the cost of 54 yd. of cloth at $\$0.16\frac{2}{3}$ a yard?

5. What is the area of a triangle whose base is 24 ft. and altitude 8 ft.?

6. If the area of a triangle is 48 sq. ft., and the altitude is 8 ft., what is the base?

7. How many board feet are there in a plank 20 ft. long, 15 in. wide, and 2 in. thick?

8. At \$1.25 a rod find the cost of building a wall one mile long.

9. If $\frac{2}{3}$ of a yard of cloth cost \$8, what will $2\frac{1}{2}$ yd. cost?

10. What is $\frac{5}{7}$ of $\frac{2}{3}$? $\frac{6}{8}$ of $\frac{3}{4}$? $\frac{7}{6}$ of $\frac{3}{7}$?

11. After losing $\frac{1}{4}$ of his money, Harry found $\frac{1}{2}$ of what he lost and then had 70 cents. How much had he at first?

12. A horse cost \$150. If $\frac{4}{5}$ of the cost of the horse is three times the cost of the sleigh, find the cost of the sleigh.

13. If 8 men can do some work in 5 days, how long will it take 4 men to do it?

14. By selling a cow for \$45, a farmer lost $\frac{1}{10}$ of what she cost. What did he pay for her?

15. A farm was sold for \$1800, which was $\frac{6}{7}$ of its cost. What was the loss?

16. If a woman spends $\$5\frac{3}{5}$ for dry goods and $\$3\frac{1}{4}$ for groceries; how much money will she spend?

17. A dealer bought 40 sheep for \$160 and sold them at \$4.50 each. Find his gain.

18. A woman went to market with \$5 and bought 4 lb. of butter at 40¢ and 5 doz. eggs at 30¢. How much money did she take home with her?

19. How many seconds are there in 2 min. 15 sec.?

1. How many acres are there in a farm 225 rd. long and 175 rd. wide?

2. How many cubic feet are there in a room 18 ft. long, 17 ft. wide, and 15 ft. high?

3. Reduce 4 mi. 213 rd. to rods.

4. How much rice at 8¢ a pound will pay for 5 bu. 3 pk. of cherries at 9¢ a quart?

5. Find the least common multiple of 13, 39, 56.

6. Find the greatest common divisor of 315 and 945.

7. Multiply $72\frac{9}{11}$ by $24\frac{4}{9}$.

8. If $\frac{2}{3}$ of an acre of land cost $\$66\frac{2}{3}$, how much will $8\frac{3}{4}$ acres cost?

9. What is the value of a pile of wood 48 ft. long, 8 ft. high, and 4 ft. wide, at $6.50 a cord?

10. Multiply 27 millionths by 12 hundredths and divide the product by 324 thousandths.

11. Change $1\frac{5}{8}$ to a decimal fraction.

12. Take four hundred and twenty-five thousandths from ten thousand, and multiply the remainder by ten hundredths.

13. The circumference of a circle is 15,708 ft. Find the radius.

14. The radius of a circle is 42 ft. What is the circumference?

15. How much are $5\frac{4}{5}$ tons of coal worth if $17\frac{2}{5}$ tons are worth $100?

16. If a train runs 48 miles in 1 hr. 20 min., how long will it take it to run 225 miles?

17. A room 20 ft. long, 17 ft. 6 in. wide will require how many yards of carpet 27 in. wide, when the breadths run lengthwise?

18. What is the width of a pile of wood 64 ft. long, 10 ft. high, if it contains 20 cords?

1. **Percentage** is the name given to that part of arithmetic where all reckoning is done by hundredths.

2. Percentage is therefore an application of decimal fractions.

3. 7% of anything is how many hundredths of it?

4. There are three problems in percentage:
   a. To find a given percentage of a number.
   b. To find what per cent one number is of another.
   c. To find a number when a percentage of it is given.

5. Find 5% of \$80.

Solution A.
$$\begin{array}{r} \$80 \\ .05 \\ \hline \$4.00 \end{array}$$

B. $5\% = \frac{1}{20}$
$\frac{1}{20}$ of \$80 = \$4.

Learn: To find a percentage of a number, multiply the number by the rate per cent expressed either decimally or as a common fraction.

6. \$150 is what per cent of \$9000?

A. $\frac{150}{9000} = \frac{1}{60}$

$\frac{1}{60}$ of $100\% = 1\frac{2}{3}\%$

B. $9000\overline{)150.00}$ $.01\frac{2}{3}$

$\begin{array}{r} 9000 \\ \hline 6000 \\ 9000 \\ \hline \end{array}$

$\frac{6000}{9000} = \frac{2}{3}$

Learn: To find what per cent one number is of another, first find what part it is and change that fractional part to hundredths.

7. \$240 is 8% of what sum?

A. $8\% = \$240$
$1\% = \frac{1}{8}$ of $\$240 = \$30$
$100\% = 100 \times \$30 = \$3000$

B. $.08\overline{)\$240.00}$ \$3000.

Learn: To find a number when a percentage of it is given, divide by the given rate to find 1%, then multiply by 100, or divide the given percentage by the rate per cent expressed decimally.

1. In a school 174 pupils are present and 6 are absent. Find the per cent of attendance, to the nearest thousandth.

2. A dealer bought 175 bu. of wheat for \$315 and sold it at \$2 a bushel. What was his gain per cent?

3. A merchant sold 73,680 ft. of lumber at \$20 per M. Find the selling price. If the merchant gained \$294.72, find the cost. Find what per cent the gain is of the cost.

4. By selling a piece of land for $16\frac{2}{3}\%$ profit, a man gained \$150. What did the land cost?

5. When goods costing \$1015 are sold at \$883.05, how much is lost? What is the per cent of loss?

6. A merchant imported 175 chests of tea. Each chest contained 45 lb., valued at 48¢ a pound. If the merchant sold the tea at a gain of 25%, find the selling price.

7. A man sold 160 acres of land at \$34 an acre. If he lost \$1360, find his loss per cent.

8. An agent sold 676 bbl. of flour at \$5.50 a barrel. If he kept $2\frac{1}{2}\%$ of the sum received as his commission, find his commission?

9. Property that cost \$320 increased in value to \$360. What was the per cent of increase?

10. The standing of 6 polo teams is as follows:

Team	Games Won	Games Lost	Per cent
Fall River	31	11	—
New Bedford	27	14	—
Pawtucket	22	—	55.0
Waterbury	18	—	50.0
Worcester	20	21	—
Providence	16	26	—

For four of the teams find what per cent of the total number of games played were won. Carry results to three decimal places. For the other two clubs find the number of games lost.

1. **Interest** is money paid for the use of money. **Principal** is the sum of money on which interest is paid. The **amount** is the sum of the principal and interest.

2. I asked a man to lend me some money. He said he would at 6% interest. What did he mean?

3. What is the interest of \$1 for 1 yr. at 6%? At 5%?

4. What is the interest on \$200 at 6% for 3 yr.?

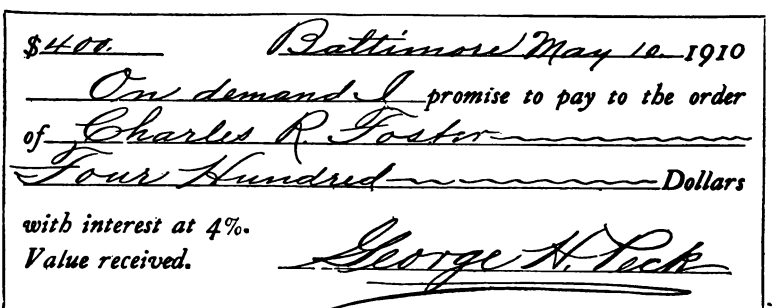
\$200
.06
\$12.00
3
\$36. = int. for 3 yr.

Learn: Multiply the principal by the rate to find the interest for 1 year. Then multiply the interest for 1 year by the number of years.

At 4%, 5%, and 6%, find the interest on:

5. \$100 for 5 yr.
6. \$200 for 6 yr.
7. \$300 for 4 yr.
8. \$400 for 4 yr.
9. \$500 for 3 yr.
10. \$600 for 3 yr
11. \$700 for 2 yr.
12. \$800 for 2 yr.

A PROMISSORY NOTE



13. The one who promises to pay is called the **promisor, maker**, or **borrower**. The one to whom the promise is made is called the **promisee, payee**, or **lender**. The **face** is the sum of money named in the note.

There are many methods of computing interest no one of which is best for all examples. In this book we shall confine ourselves to the method illustrated in Lesson 30 and to the following 60 *day method*, also called *banker's method*.

1. Since the interest on \$1, for 12 mo. is \$.06, the interest for 2 mo. or 60 days will be 1 cent (\$.01). Since the interest on \$1 for 60 days is \$.01, the interest for 6 days will be 1 mill (\$.001).

2. Hence to find the interest at 6% on any sum of money for 2 mo. or 60 d., move the decimal point two places to the left. To find the interest for 6 days, move the point three places to the left.

3. Find the interest on \$650 for 3 yr. 5 mo. 12 d. at 6%.

\$6.50 = int. for 2 mo.
.65 = int. for 6 days
\$39.00 = int. for 1 yr.
78.00 = int. for 2 yr.
13.00 = int. for 4 mo.
3.25 = int. for 1 mo.
1.30 = int. for 12 d.
\$134.55 = int. for 3 yr. 5 mo. 12 d.

By moving the point find the interest for 2 mo. and also for 6 days. Draw a line to separate these sums from the work below. Take such multiples or parts of these sums as will give the interest for the required time. Do the work mentally, not writing multipliers.

4. Find the interest at 6% on \$715 for 75 days.

\$7.15 = int. for 60 d.
1.787 = int. for 15 d.
\$8.937 = int. for 75 d.
\$9.94 = *Ans.*

First find the interest for 60 days. The interest for 15 d. will be $\frac{1}{4}$ of the interest for 60 d. A little practice will make you skilful in discovering the easiest way to find the interest for different periods. It is sufficiently accurate to retain only mills in the partial results, and express the final result to the nearest cent.

Find the interest at 6% on:

5. \$1078.25 for 90 days.
6. \$ 633.50 for 1 yr. 5 mo. 20 d.
7. \$2070.80 for 2 yr. 7 mo. 17 d.
8. \$74.63 for 1 yr. 6 mo. 18 d.
9. \$279.75 for 75 days.

1. Find the interest on \$840 at 6% from Jan. 10, '10 to May 25, 1912.

From Jan. 10, '10 to Jan. 10, '12 = 2 yr.
From Jan. 10, '12 to May 10, '12 = 4 mo.
From May 10, '12 to May 25, '12 = 15 da.

\$8.40 = int. for 2 mo.
.84 = int. for 6 da.
50.40 = int. for 1 yr.
50.40 = int. for 1 yr.
16.80 = int. for 4 mo.
2.10 = int. for 15 da.
\$119.70 = int. for 2 yr. 4 mo. 15 da.

From a study of this solution you will see that we first find the full years, then the months, then the exact days remaining. As soon as possible you should do this work mentally, writing only results. This method of subtracting dates is usually used by the banks as more accurate.

2. To find the interest at any given per cent, first find the interest at 6%, then add to or subtract from it such parts as will give the required per cent as: 5% = 6% − 1%; 7% = 6% + 1%; 7½% = 6% + ¼ of 6%; 8% = 6% + ⅓ of 6%; etc.

Find the interest on:

3. \$845 for 6 mo. 24 da. at 4%.
4. \$46.50 for 125 days at 6%.
5. \$10,000 for 63 days at 5%.
6. \$640.80 for 4 yr. 7 mo. 11 da. at 7%.
7. \$459.30 from Dec. 14, 1909, to May 5, 1911 at 5%.
8. \$658.48 from Aug. 17, 1910 to Apr. 4, 1912 at 7%.
9. \$2184 from Jan. 24, 1910 to Mar. 30, 1913 at 6%.
10. \$609.50 from Mar. 5, 1909 to Sept. 14, 1911 at 4½%.
11. \$489.25 from May 5, 1910 to Aug. 11, 1911, at 5%.
12. \$625.50 from Aug. 15, 1910, to Dec. 29, 1914 at 4%.
13. \$1827 from Jan. 16, 1910 to Oct. 11, 1911 at 4%
14. \$945.96 from June 4, 1910 to Sept. 10, 1912 at 4½%.
15. \$946.25 for 90 days at 4½%.

1. A merchant sold a dozen oranges for 18 cents. If they cost him 24 cents, what per cent did he lose?

2. If a merchant bought oranges for 18 cents a dozen and sold them for 24 cents, what per cent would he gain?

3. If a dealer sells goods for double what they cost him, what per cent does he make?

4. A man sold a horse for \$90 and gained 20%. At what per cent did he sell the horse? Find the cost of the horse?

5. When cloth that cost \$6 a yard is sold for \$4 a yard, what is the loss per cent?

6. At 10 cents a half pound, what must you pay for $2\frac{1}{4}$ lb. of honey?

7. Find the interest on \$500 for 120 days at 6%.

8. A merchant bought 8 desks at \$24.75 each, and sold them at \$25 each. Find the entire gain.

9. If $\frac{3}{4}$ of a ton of hay cost \$15, what will $2\frac{1}{2}$ tons cost?

10. Belle spent $\frac{1}{3}$ of her money for candy, and 15 cents for ribbon. If she then had 25¢, how much had she at first?

11. At 5% find the interest on \$50 for one year.

12. At 6% find the interest on \$60 for 60 days.

13. A can do a piece of work in 3 days, B in 4 days. How much can each do in a day? How much can both do in a day? How many days will it take, both working together, to do the whole work?

14. A is 40 yd. ahead of B. If B runs 5 yd. while A runs 4 yd., how many yards must B run to overtake A?

15. A dealer went into the country and bought eggs at 25¢ a dozen, and brought them into the city and sold them at 30¢ a dozen. What was his gain per cent?

16. At the same time he bought potatoes at 60¢ a bushel and sold them at 25¢ a peck. What was his gain per cent?

1. A circular fountain has a radius of 10 ft. Outside of it is a walk 5 ft. wide. How many square feet are there in the walk?

2. Find the area of a gravel walk 6 ft. wide just inside a fence surrounding a lot 320 ft. by 210 ft.

3. Find the amount of \$639.80 from July 25, 1910, to Jan. 6, 1913, at $7\frac{1}{2}\%$.

4. A carriage wheel is 4 ft. in diameter. How many feet has it passed over when it has made 636 revolutions?

5. The area of a trapezoid is 32,400 sq. yd., and the two parallel sides are 124 yd. and 200 yd. Find the altitude.

6. The area of a trapezoid is 280 sq. rd., and the perpendicular is 14 rd. Find the sum of the parallel sides. If one side is 6 rd., what is the other side?

7. At \$4.60 a cord, find the cost of a pile of wood 8 ft. long, 4 ft. wide, and 5 ft. high. Find the number of cords in this pile without finding the number of cubic feet.

8. The width of a gable of a house is 30 ft. and its perpendicular height is 20 ft. Find the cost of boards for covering the two gables at \$16 per M.

9. A rectangular field, containing 27 A, is 40 rd. wide. What will it cost to fence it at \$1.10 a rod?

10. At \$1.20 a yard, what will be the cost of carpet 27 in. wide, laid lengthwise on the floor of a room 24 ft. 6 in. by 18 ft?

11. At 9¢ a cubic foot, find the cost of a block of stone, $9' \times 5\frac{1}{2}' \times 4'$.

12. Write the following as a bill, supplying names and date: 32 lb. soap @ $7\frac{1}{8}$¢; 24 lb. starch @ $5\frac{3}{4}$¢; 80 lb. of sugar @ $6\frac{1}{2}$¢; 62 gal. of vinegar @ 25¢; 28 lb. coffee @ 33¢; 42 lb. of butter @ 35¢. Deduct 5% from the bill for cash.

13. As bookkeeper for the creditor, write a receipt in full to be given to the debtor.

14. In every bill who is the creditor? Who is the debtor?

1. How many bushels of apples will a bin contain that is 30′ long, 8′ wide, and 9′ high?

$(30 \times 8 \times 9)$ cu. ft. $= 2160$ cu. ft.
2160 cu. ft. $\div 1\frac{1}{2}$ cu. ft. $= 1440$ bu. } or $30 \times 8 \times 9 \times \frac{2}{3}$ bu. $= 1440$ bu.

2. A bin 24 ft. long, 6 ft. wide, and 2 ft. deep is $62\frac{1}{2}\%$ full of oats. How many bushels are in the bin?

$\frac{5}{8} \times (24 \times 6 \times 2)$ cu. ft. $= 180$ cu. ft.
180 cu. ft. $\div 1\frac{1}{4}$ cu. ft. $= 144$ bu. } or $\frac{5}{8} \times 24 \times 6 \times 2 \times \frac{4}{5}$ bu. $= 144$ bu.

3. In measuring grain, etc., the even bushel is used. This contains 2150.4 cu. in., or approximately $1\frac{1}{4}$ cubic feet. In measuring bulky fruits the heaped bushel is used. This contains 2688 cu. in. or approximately $1\frac{1}{2}$ cu. ft. Hence 1 cu. ft. equals $\frac{4}{5}$ bu. or $\frac{2}{3}$ bu., depending upon the article measured.

Learn: a. For accurate purposes divide the number of cubic inches in the bin by 2150.4 cu. in. when using the even bushel, and by 2688 cu. in. when using the heaped bushel.

b. For practical purposes take $\frac{4}{5}$ or $\frac{2}{3}$ of the number of cubic feet in the bin for the required number of bushels.

4. A bin 6 ft. wide and 10 ft. long holds 150 bu. potatoes. How high is the bin?

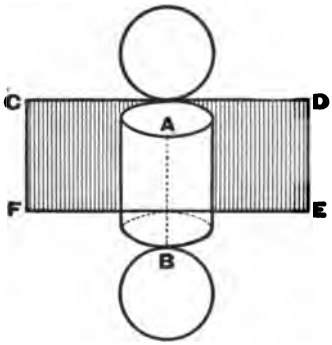
$150 \times 1\frac{1}{2}$ cu. ft. $= 225$ cu. ft.
$10 \times 6 \times x = 225$ cu. ft.

5. A bin is 6 ft. wide and $4\frac{1}{2}$ ft. deep. If it contains 324 bu. of potatoes, how long is it?

Find the number of cubic feet in a bin that holds :

6. 600 bu. of wheat
7. 400 bu. of apples.
8. 400 bu. of oats.
9. 1200 bu. of potatoes.
10. 900 bu. of shelled corn.
11. 1500 bu. of onions.

12. At $1.05 a bushel, find the value of the wheat that fills $\frac{2}{3}$ of a bin $12\frac{1}{2}' \times 6 \times 9'$.



1. Make a paper cylinder and cut it on the line AB as in Fig. 1. Open to a flat surface. What form have you?

2. The rectangle CDEF formed the curved surface of the cylinder. The curved surface is usually called the **convex surface.**

3. The two circles formed what part of the cylinder?

Learn: To find the entire surface of a cylinder:

a. Multiply the circumference by the height to find the convex surface.

b. To the convex surface add the areas of the two ends.

Find the entire surface of cylinders having the following dimensions, calling π $3\frac{1}{7}$.

4. Circumference 88 ft., height 24 ft.

5. Circumference 132 ft., height 30 ft.

6. Diameter 28 ft., height 40 ft.

7. Find the volume of a cylinder whose diameter is 21 in. and height 14 in. How many gallons will this cylinder hold?

$3\frac{1}{7} \times 21$ in. = 66 in. cir.
$(10\frac{1}{2} \times 33)$ sq. in. = area of base.
$(10\frac{1}{2} \times 33 \times 14)$ cu. in. = volume.
$10\frac{1}{2} \times 33 \times 14 \times 7\frac{1}{2}$ gal. = gal.

First find the area of the base. Multiply this by the height to find the volume. Since there are $7\frac{1}{2}$ gal. in a cubic foot multiply $7\frac{1}{2}$ gal. by the number of cubic feet in the volume.

Learn: To find the volume of a cylinder multiply the area of the base by the height.

Find the capacity in gallons of cisterns of the following dimensions, calling π 3.1416.

8. Diameter 6 ft., height 6 ft.

9. Circumference 25 ft., height 15 ft.

1. How many bricks will be required to build a wall 84 ft. long, 32 ft. high, and 1 ft. thick? 22 bricks make 1 cu. ft. of wall.

2. How many 3-in. cubes can be cut from a block 27 in. long, 12 in. wide, and 9 in. thick, if no allowance is made for waste in cutting?

3. What is the area in acres of a triangle whose base is 56 rd., and altitude is 64 rd?

4. At $45 an acre find the value of a piece of land whose parallel sides are 40 rd. and 30 rd. and whose altitude is 60 rd.

5. A tank 9 ft. deep, 14 ft. long, and $7\frac{1}{2}$ ft. wide is $\frac{2}{3}$ full of water. At the rate of 5 gal. a minute, how long will it take to pump out the water?

6. At $72 an acre a farm is worth $12,240. What will it cost to fence it at $1.25 a rod, it if is in the form of a rectangle 160 rd. wide?

7. A bin is 8.5 ft. long, 4.25 ft. wide, and 3.75 ft. deep. How many bushels of oats will it hold?

8. At $4.25 a cord, what is the value of a pile of wood 72 ft. long, 4 ft. wide, and 12 ft. high? Find the number of cords in the pile without finding the number of cubic feet.

9. At $18 per M, find the cost of planks for flooring a barn 40 ft, by 32 ft., if each plank is 16 ft. long, 15 in. wide, and 2 in. thick.

10. What is the circumference of the largest circle that can be drawn on a 9-ft. square?

11. The area of a triangle is 36 sq. yd., and the base is 36 ft. What is the altitude?

12. If a bin is 8 ft. square, how deep must it be to hold 256 bu. of apples?

13. At 15¢ a square rod, what will it cost to cover with gravel a driveway $49\frac{1}{2}$ ft. wide round the outside of a circular park 36 rd. in diameter?

1. At 6% a year find the interest on \$1000 for 48 da.

2. A farmer sold a horse for \$105 and gained $16\frac{2}{3}\%$. What did the horse cost?

3. A teacher said, "I should have 50 pupils in my room, but 5% are absent." How do you know she made a mistake?

4. At \$1 per C, find the cost of 10 boards, each 12 ft. long, and 10 in. wide.

5. When a number is used twice as a factor, that is, is multiplied by itself, the product is called the **square** of the number.

6. Name the squares of 3, 5, 6, 8, and 12.

7. Use 4 three times as a factor. $4 \times 4 \times 4 =$ ——.

8. When a number is used three times as a factor the product is called the **cube** of the number.

9. Name the cubes of 2, 5, 3, 8, and 10.

10. At \$13.50 each, how much will 100 trunks cost?

11. At \$2.50 each, how many chairs can be bought for \$50?

In the following examples give the answer in terms of both the minuend and subtrahend:

12. 3 lb. − 32 oz.
13. 4 hr. − 180 min.
14. 4 yr. − 36 mo.
15. 5 yd. − 12 ft.
16. 5 ft. − 48 in.
17. 9 ft. − 2 yd.
18. \$12 − 350¢
19. 2 T − 2000 lb.
20. 5 dimes − 20 ct.
21. 4 bu. − 8 pk.
22. 6 pk. − 24 qt.
23. 10 qt. − 8 pt.

24. *Find the missing terms :*

Minuend	45	x	43	53	x	61	x	95	74
Subtrahend	x	36	27	x	34	29	64	x	39
	24	15	x	11	42	x	19	32	x

1. If a number is multiplied by 8 the product is 480. What is the number?

2. Find the interest on \$600 from Aug. 16, to Nov. 24, at $7\frac{1}{2}\%$.

3. What will 8 lb. 12 oz. of butter cost if $1\frac{1}{2}$ lb. cost 54 cents?

4. What is a mixed number? Write one. Change it to some other form without changing its value.

5. A rectangular garden is 200 ft. long and 150 ft. wide. Find the area of a walk running all round it and also through the center in both directions.

6. If it requires 440 ft. of lumber to cover the gable ends of a barn 40 ft. wide, what is the height of the gable?

7. How long a band of iron will it take to surround a cylindrical tank 15 ft. 8 in. in diameter?

8. There are 360 persons in a room 60 ft. long by 40 ft. wide. To allow 100 cu. ft. of air to each person, how high ought the room to be?

9. At 27¢ a square yard find the cost of plastering a room 22 ft. 3 in. long, 16 ft. wide, and 12 ft. high. There are 2 windows, each 6′ by $3\frac{1}{2}$′; 4 doors, each 7′ by 4′, and a baseboard 9 in. high.

10. A tank can be filled by one pipe in 15 min., and by another in 30 min. In what time can it be filled by both together?

11. Suppose water runs in through the first pipe and out through the other. In what time then will the tank be filled?

12. What will 25 bu. 3 pk. 2 qt. of cherries cost at 8¢ a quart?

13. A room is 16 ft. 4 in. by 15 ft. How many yards of carpet, $\frac{3}{4}$ yd. wide, will it take for the room, if the breadths run widthwise and there is a waste of 6 in. on each breadth for matching?

At 6% find the interest for 18 days on:

1. $40	2. $210	3. $2400	4. $16,000
5. $50	6. $160	7. $1200	8. $15,000
9. $60	10. $540	11. $1000	12. $48,000
13. $70	14. $250	15. $4400	16. $64,000

Divide:

17. .025 by .5	18. .018 by .6	19. .63 by .9
20. .273 by .3	21. .45 by .5	22. .24 by .2
23. 6.25 by .5	24. 40 by .04	25. 36 by .06
26. 5.6 by .7	27. 86.4 by .08	28. 8.1 by .9

Multiply:

29. 16 by 10	30. 1.6 by 10	31. .16 by 10
32. 36 by 100	33. 3.6 by 100	34. .36 by 100
35. 15 by .1	36. 1.5 by .1	37. .15 by .1
38. 9 by .1	39. 9 by .01	40. 9 by .001

Change to common fractions in their lowest terms:

41. .25	42. .5	43. .80	44. .125	45. .375
46. .4	47. .04	48. $.33\frac{1}{3}$	49. $.16\frac{2}{3}$	50. $.14\frac{2}{7}$
51. $.28\frac{4}{7}$	52. .625	53. 1.5	54. 2.25	55. .600

Find the cost of 36 articles at:

56. 50¢ each	57. $1.50 a dozen	58. 25¢ each
59. $33\frac{1}{3}$¢ each	60. $.75 a dozen	61. $\$1.83\frac{1}{3}$ each
62. $12\frac{1}{2}$¢ each	63. $1.25 a dozen	64. $\$1.16\frac{2}{3}$ each

What part of:

65. 50 is 10?	66. 5 is $2\frac{1}{2}$?	67. 10 is $3\frac{1}{3}$?
68. 100 is 40?	69. 80 is 25?	70. 6 is $1\frac{1}{2}$?
71. 25 is $12\frac{1}{2}$?	72. 100 is $66\frac{2}{3}$?	73. 100 is $62\frac{1}{2}$?
74. $16\frac{2}{3}$ is $8\frac{1}{3}$?	75. $12\frac{3}{5}$ is $4\frac{1}{5}$?	76. 18 is $4\frac{1}{2}$?

NOTE: — In measuring cellars and buildings in estimating for bricks or stone work, masons measure the outside of the walls, thus counting each corner twice. This is considered fair because of the greater labor in constructing the corners. For the same reason no allowance is made for an opening unless it is a large one, when one half of the opening is deducted.

1. Estimate the number of bricks required for a church $120' \times 85' \times 30'$. The walls are 2 ft. thick, and there are 12 windows, each 3 ft. by 6 ft. and 4 doors, each 5 ft. by 10 ft.

$2\ (120 + 75)$ ft. $= 390$ ft. length.
$(390 \times 30 \times 2)$ cu. ft. $= 23{,}400$ cu. ft.
$\frac{1}{2}\ (12 \times 3 \times 6 \times 2)$ cu. ft. $= 216$ cu. ft. in windows.
$\frac{1}{2}\ (4 \times 5 \times 10 \times 2)$ cu. ft. $= 200$ cu. ft. in doors.
$\{23{,}400 - (216 + 200)\} \times 22$ bricks $=$ ——.

2. Estimate the quantity of bricks required for a house $48' \times 25' \times 21'$. The walls are 1 ft. thick, and 480 cu. ft. are allowed for openings.

3. A room is 30 ft. long, $22\frac{1}{2}$ ft. wide, and 10 ft. 8 in. high. Making no allowance for openings find the cost for papering the walls and ceiling at 75¢ a roll, and of molding at 10¢ a foot.

4. What is the value of a lot of land 75 ft. deep, 50 ft. wide in front and 42 wide in the rear, at 65¢ a square foot?

5. If $\frac{5}{11}$ of an acre of land cost \$37.75, what will $43\frac{1}{5}$ acres cost?

6. A man owned $\frac{5}{8}$ of an acre of land. How much had he left, after selling $28\frac{3}{4}$ square rods?

7. A man had a circular pond 30 yd. in diameter. He made a circular walk round it 6 ft. wide. Find the area of the walk.

8. How many square feet of zinc will be required to line completely a cylinder 8 ft. in diameter and 40 ft. high?

9. At 55¢ a cubic yard, what will it cost to dig a well 5 ft. in diameter and 30 ft. deep?

10. Find the number of board feet in 14 planks, 15 ft. long, 16 in. wide, and 3 in. thick.

Review Lesson 28.

1. What does the term *per cent* mean?

Express by fractions in their lowest terms the following:

2. 2% 3. 5% 4. 8% 5. 10% 6. $12\frac{1}{2}\%$
7. 15% 8. $16\frac{2}{3}\%$ 9. 20% 10. 25% 11. $33\frac{1}{3}\%$
12. 40% 13. 50% 14. 60% 15. $62\frac{1}{2}\%$ 16. $66\frac{2}{3}\%$
17. 70% 18. 75% 19. 80% 20. $83\frac{1}{3}\%$ 21. $87\frac{1}{2}\%$

Give results quickly:

22. 10 % of 40. 23. 40% of 60. 24. $37\frac{1}{2}\%$ of \$64.
25. $62\frac{1}{2}\%$ of \$4.40. 26. $33\frac{1}{3}\%$ of \$12. 27. $12\frac{1}{2}\%$ of \$4.80.
28. $\frac{3}{5}\%$ of \$100. 29. $66\frac{2}{3}\%$ of \$6. 30. 75% of \$400.
31. How do you find a percentage of a given number?
32. 9 is 50% of what? 33. 6 is 2% of what?
34. 10 is 25% of what? 35. 9 is 3% of what?
36. 12 is $12\frac{1}{2}\%$ of what? 37. 15 is $16\frac{2}{3}\%$ of what?
38. 15 is 5% of what? 39. 2 is 10% of what?
40. How do you find what per cent one number is of another?
41. What part of 15 is 5? How many hundredths of 15 is 5? What per cent of 15 is 5?

What per cent of:

42. 60 is 12? 43. 32 is 16? 44. $\frac{1}{2}$ is $\frac{1}{4}$?
45. .8 is .1? 46. $\frac{1}{4}$ is $\frac{1}{8}$? 47. .01 is .001?
48. $\frac{1}{3}$ is $\frac{1}{6}$? 49. 1 ft. is 6 in.? 50. 1 qt. is 1 pt.?
51. Find 20% of 50 men. 70% of 120 yr. 25 % of 120 bu.
52. 40 is 25% of what number? 60 is 10% of what number? 80 is 40% of what number?
53. What per cent of 75 is 15? Of 80 is 40? Of 80 is 32?
54. A house was bought for \$4400 and sold at a gain of 25%. What was the gain? What was the selling price?

1. The number of which a certain number of hundredths is to be taken is called the **base.**

2. The number of hundredths that we take of the base is called the **rate** or the **rate per cent.**

3. The result obtained by taking a certain per cent of the base is called the **percentage.**

4. Find 5% of $300.

$300 Base
.05 Rate
$15.00 Percentage

The percentage is the product of the base and the rate. You can see that the base is the multiplicand, the rate is the multiplier, and the percentage is the product.

5. Fill in the blanks in the following:
   a. Multiply the base by the rate to find the ——.
   b. Divide the percentage by the rate to find the ——.
   c. Divide the percentage by the base to find the ——.

Find the missing term in the following:

	Base	Rate	Percentage		Base	Rate	Percentage
6.	$70	4%	x	7.	x	2%	$40
8.	$850	x	$425	9.	$8.20	105%	x
10.	x	3%	$7.50	11.	$108	x	$5.40

12. The increase in population in one year in a certain town was 5000, which was $15\frac{5}{8}\%$ of the population. What was the population at the end of the year?

13. A man bought an automobile for $1250, and sold it at a loss of $500. Find the per cent of loss?

14. A farmer cut 339 tons of hay this year. If this is an increase of 13% over what he cut last year, how many tons did he cut last year?

15. For the month of December, James received a mark in spelling of 87%. If he missed 52 words during the month, how many did he spell correctly?

16. During January, James was given 400 words to spell. If he spelled 368 correctly, what is his per cent mark for the month?

1. The excess of the selling price over the cost is **profit.**

2. The excess of the cost over the selling price is **loss.**

3. The selling price is always the cost plus the profit or the cost less the loss.

4. The gain or loss per cent is always reckoned on the cost.

5. For how much must a merchant sell goods that cost \$450, so as to gain 10%?

$\frac{1}{10}$ of \$450 = \$45.
\$450 + \$45 = \$495.

10% = $\frac{1}{10}$. $\frac{1}{10}$ of \$450 = \$45, the gain. \$450 + \$45 = \$495, the selling price.

6. Some goods were marked to be sold for \$60, but being damaged were sold at a loss of 15%. Find the selling price.

15% of \$60 = \$9, the loss.
\$60 − \$9 = \$51, the selling price.

7. A boy sold his bicycle for \$81 at a loss of 10%. Find the cost of the bicycle.

100% − 10% = 90%, the selling per cent.

90% = \$81.
1% = $\frac{1}{90}$ of \$81 = \$.90
100% = 100 × \$.90 = \$90

or

$$90\overline{)8100.}\quad \$90$$

8. A dealer bought some goods for \$640 and sold them for \$716.80. What was his gain per cent?

\$716.80 − \$640 = \$76.80 gain
\$76.80 ÷ \$640 = .12 ∴ 12%

First find the gain, then find what per cent the gain is of the cost.

9. A man bought a lot for \$850 and sold it at a gain of 25%. If he sold it at 15% less than he asked for it, find his asking price.

\$850 + $\frac{1}{4}$ of \$850 = \$1062.50, the selling price.

85% = \$1062.50.
100% = \$1250.

If he sold it for 15% less than he asked for it, the selling price must be 85% of the asking price.

NOTE: — These are typical problems and should be studied carefully.

1. A dealer lost 15% by selling eggs at 17¢ a dozen. Find the cost of a dozen.

2. A merchant's income is \$5730 this year. This is a gain of $18\frac{3}{4}\%$ on the capital invested. His income last year was 25% of the capital. Find his income last year.

3. If goods that cost \$.84 a yard are sold at \$.63, what is the loss per cent?

4. A lady spent \$64.50 for jewelry and dress goods, paying 15% more for dress goods than jewelry. How much did she pay for each?

Let 100% = money paid for jewelry
and 115% = money paid for dress goods
then 215% = \$64.50.

5. A and B together have \$1680, and A has 25% less money than B. How much money has each?

6. Find the cost of a ton of hay which was sold at \$15 at a gain of 20%.

7. What would have been the gain per cent if the hay in example 6 had been sold at \$13.50 a ton?

8. A earns 18% more in a week than B. If the sum of their wages is \$76.30, how much does each earn?

9. A man spent $62\frac{1}{2}\%$ of the money he withdrew from a bank for an automobile that cost \$1250. How much did he withdraw? If he withdrew $33\frac{1}{3}\%$ of all he had on deposit, what was the original deposit?

10. When the selling price was \$63, the rate of loss was $12\frac{1}{2}\%$. Find the cost.

11. A merchant bought 960 yd. of silk at \$2.00 a yard. He sold $\frac{1}{4}$ of the silk at a gain of 25%, $\frac{1}{3}$ of it at a gain of 20%, and the remainder at a loss of 15%. For what was the silk sold?

12. A man sold 5000 bu. of wheat for \$300 less than it cost him, and thus lost 12%. What did the wheat cost him a bushel?

1. Mr. Walker owns a house valued at \$6000. He insures it for $\frac{3}{4}$ of its value in the Home Fire Insurance Co. This means that the company promise to pay him \$4500 if the house is burned, within 5 years.

2. For this promise Mr. Walker pays the company $1\frac{1}{2}\%$ of the amount for which the property is insured. Find $1\frac{1}{2}\%$ of \$4500.

3. Security against loss or damage of any kind is called **insurance.**

4. There are several kinds of insurance. The more common forms are **fire insurance, marine insurance, accident insurance** and **life insurance.** The first insures against any loss by fire, the second against any loss at sea, the third against any loss from an accident, and the fourth against loss of life.

5. The written agreement between the company and the person insured is called a **policy.**

6. The sum paid for the insurance is the **premium.** The premium is a certain per cent of the amount named in the policy.

7. The insurer is often called the **underwriter.**

8. Property is usually insured by the underwriters for less than its full value.

ORAL EXERCISES

9. A house valued at \$8000 was insured for $\frac{3}{4}$ of its value at $1\frac{1}{2}\%$. What was the premium?

Find the premium in the following:

	Value	Part Insured	Rate		Value	Part Insured	Rate
10.	\$600	$\frac{5}{6}$	3%	11.	\$1600	$\frac{3}{4}$	2%
12.	\$800	$\frac{3}{4}$	2%	13.	\$10,000	$\frac{3}{4}$	1%
14.	\$1500	$\frac{4}{5}$	$1\frac{1}{2}\%$	15.	\$5000	$\frac{4}{5}$	$1\frac{1}{2}\%$
16.	\$2000	$\frac{3}{4}$	1%	17.	\$9000	$\frac{2}{3}$	1%
18.	\$2400	$\frac{2}{3}$	1%	19.	\$12,000	$\frac{5}{6}$	$1\frac{1}{2}\%$

1. A ship worth \$52,000 was insured for $\frac{3}{4}$ of its value at $2\frac{1}{2}\%$. The cargo worth \$8640 was insured for $\frac{2}{3}$ of its value at 3%. Find the whole premium.

2. A house worth \$12,000 is insured for $\frac{2}{3}$ of its value. Find the premium, if the rate is $1\frac{3}{5}\%$.

3. Mr. J. paid \$250 for insurance on his stock of goods. If the face of the policy was \$10,000, what was the rate of insurance?

4. When the premium is \$350 and the rate of insurance is 5%, find the the face of the policy. If the property is insured for $\frac{3}{4}$ of its value, find the whole value.

5. How large an insurance can a man place on his house by paying a premium of \$122.50, if the rate of insurance is $1\frac{3}{4}\%$?

6. A man insures his life for \$2500, at the rate of \$22.50 for every \$1000. What is his annual premium?

7. A man insured his life for \$3000, paying \$24.25 semi-annually for every \$1000. Find the total amount paid in premiums in 12 years. At his death his wife received \$3000. How much more did she receive than had been paid in premiums?

8. A factory valued at \$50,000 is insured for $\frac{3}{5}$ of its value. If the premium is \$500, what is the rate of insurance?

9. If a merchant pays \$150 for insuring \$8000 worth of goods, what is the rate of insurance?

10. \$206.25 was the premium paid for insuring a factory at $1\frac{3}{8}\%$. Find the face of the policy.

11. A man insured his barn for $\frac{3}{4}$ of its value at $1\frac{1}{4}\%$, and paid a premium of \$15. Find the value of the barn.

12. A man paid \$87 for insuring his house worth \$7250. What was the rate of insurance?

13. A house worth \$3500 is insured for $\frac{3}{5}$ of its value at $1\frac{3}{4}\%$. Find the premium.

1. Mr. Snow sold $1200 worth of goods for Mr. Ryan, and asked 2% for making the sale. How much did Mr. Snow receive? After paying Mr. Snow how much did Mr. Ryan receive for his goods?

2. A person who transacts business for another is called an **agent.** Agents are known by different names according to the work they do, as, a **broker,** a **collector,** a **commission merchant.**

3. The money paid to the agent for his work is called **commission** or **brokerage.**

4. Agents receive money for their employers by collecting debts or selling property and their commission is some per cent of the money received.

5. Agents also expend money for their employers and then their commission is some per cent of the money paid out.

6. The money left after the commission and all other expenses have been paid is called the **net proceeds.**

7. The entire cost of a purchase is the price paid plus the commission and all other expenses.

ORAL EXERCISES

Find the commission on the following sales at specified rates:

8. $800, 2%.	9. $700, 3%.	10. $1500, $3\frac{1}{2}$%.
11. $1000, 5%.	12. $4768, 1%.	13. $2000, $2\frac{1}{4}$%.
14. $200, 20%.	15. $3200, $1\frac{1}{2}$%.	16. $6000, $1\frac{1}{2}$%.
17. $900, $1\frac{1}{2}$%.	18. $1800, 2%.	19. $10,000, 25%.

20. An agent sold $4000 worth of goods at $1\frac{3}{4}$% commission. Find the commission.

21. A collector's commission at 3% for collecting a debt was $60. How much did he collect?

22. An agent charged $100 for selling a farm for $2000. What was the rate of his commission?

1. An agent bought 70 bbl. of flour at \$5.25 a barrel. His commission was 3%. Find his commission. Find the total cost to the merchant.

2. A commission merchant sold a lot of goods for \$1480, charging $2\frac{1}{2}$ commission. Find the commission. What sum should he remit (send back) to his employer?

3. A broker bought some goods for a merchant for which he paid \$2146. His commission for buying was $\frac{1}{2}$%. What did the goods cost the merchant?

4. A collector charged 3% for collecting bills. In one month he received \$345. How much did he collect?

5. An agent sold 23 wagons at \$85 each on 6% commission. Find the net proceeds.

6. Mr. A. received \$7990 as the net proceeds for his farm sold by an agent on 6% commission. Find the selling price of the farm.

7. A collector charged a commission of $3\frac{1}{2}$%. If he collected 95% of a debt of \$2148, what sum should he send his employer?

8. What will be the net proceeds of a sale of 525 bbl. of beef at \$18.25 a barrel, allowing 3% commission and 5¢ a barrel for storing?

9. An agent's commission at $4\frac{1}{2}$% for selling horses was \$270. If he sold 40 horses, find the selling price of each horse.

10. An agent sent his employer \$7742.10 as the net proceeds of a sale and kept \$117.90 as his commission. What was the rate of his commission?

11. Keeping 5% for his services, an agent remitted \$237.50 to his employer. For how much did he sell the goods?

12. A real estate dealer sold 75 lots of land at \$275 a lot. If he charged 2% commission for selling and \$5 a lot for recording the deed, what will be the net proceeds of the sale?

In their catalogue the publishers mark the price of the Standard Dictionary as $25.00, but allow a reduction of 10% from this price for cash. How much is the reduction? What is the price of the dictionary after the reduction?

1. A reduction from the marked or list price of an article is called **commercial discount** or **trade discount.**

2. Manufacturers and dealers issue price lists of their goods. Such a list is called the **list price.** The price remaining after all discounts have been taken away is the **net price** or **net amount.**

3. Frequently in trade several discounts are made which vary as the condition of the market varies.

4. What is due on a bill of $500, subject to a discount of 20% and 10%?

A.
100% − 20 = 80%.
10% of 80% = 8%.
80% − 8% = 72%.
72% of $500 = $360.

B.
20% of $500 = $100.
$500 − $100 = $400.
10% of $400 = $40.
$400 − $40 = $360.

NOTE: — A study of B will show you that the first discount is taken from the list price, the second discount is taken from the remainder, and so on.

5. Find the net amount of a bill of $1440 with 25%, 10%, and 5% off.

Find the net amount of a bill of:

6. $1920 with 25% and $7\frac{1}{2}$% off.

7. $1275 with 20% and 15% off.

8. $1088 with 20%, 10%, and 5% off.

9. Find the net price of 480 lb. of tea at $62\frac{1}{2}$¢ a pound, with $37\frac{1}{2}$% and 15% off.

10. Find the net amount of a bill of $1285, if the discounts are $\frac{1}{5}$ and 5%.

11. On a bill of $1826, discounts of 40% and 10%, or 30% and 20% were offered. Which discount should you accept? How much would you save?

1. A bill of goods at list price amounted to \$750. If the net price was \$625, what was the per cent of discount?

2. After a discount of 15% the net amount of a bill was \$552.50. What was the face of the bill?

3. Find a single discount equivalent to discounts of 15% and 10%.

$$\begin{aligned} 100\% - 15\% &= 85\%. \\ 10\% \text{ of } 85\% &= 8\tfrac{1}{2}\%. \\ 15\% + 8\tfrac{1}{2}\% &= 23\tfrac{1}{2}\%. \end{aligned}$$

4. Find a single discount equivalent to discounts of 45% and 10%.

5. The list price of a bill of goods amounted to \$1672. If the discounts were 30%, 10%, and 5%, find the net price.

6. What is the marked price of goods sold for \$94.50 after discounts of 30% and 10% have been deducted?

A.
$$\begin{aligned} 100\% - 30\% &= 70\%. \\ \$94.50 \div .70 &= \$135. \\ 100\% - 10\% &= 90\%. \\ \$135 \div .90 &= \$150. \end{aligned}$$

B.
$$\begin{aligned} 100\% - 30\% &= 70\%. \\ 10\% \text{ of } 70\% &= 7\%. \\ 70\% - 7\% &= 63\%. \\ \$94.50 \div .63 &= \$150. \end{aligned}$$

7. Find the marked price of a piano sold for \$135 after discounts of $16\frac{2}{3}\%$ and 10% have been deducted.

8. Find the marked price of goods sold for \$98 after discounts of $12\frac{1}{2}\%$ and $12\frac{1}{2}\%$ have been deducted.

9. A dealer bought a chair, the list price of which was \$3.50 at discounts of 20% and 5%. If he sold it at 14% above the list price, how much did he gain?

10. Deduct 20% and 5% from the following bill:

25 lb. crushed sugar, at 10¢; 40 lb. maple sugar at 12¢; 6 lb. cheese, at 13¢; 8 lb. butter, at 28¢; 4 lb. raisins, at 13¢; 2 lb. cream tartar, at 35¢. What is the net amount of the bill?

11. What is the retail price of a dictionary if it cost \$18 after a discount of 10% had been allowed?

1. To what sum will \$100 amount when on interest at 6% for 2 yr. 6 mo.?

2. For how much can a merchant insure his store at 5%, if he pays a premium of \$50?

3. A ship worth \$60,000 was insured at 4%. What was the premium?

4. A bill of goods amounting to \$500 was bought at a discount of 10%. What was the net price?

5. At 6% find the interest for 12 days on the following sums of money: \$3000, \$840, \$1500, \$620, \$3500, \$2400.

6. Find the commission that an agent should receive for selling 40 bbl. of flour at \$5 a barrel, if he receives 3%.

7. A man sold his automobile at a loss of 20%. If he received \$1200 for it, find the cost.

8. 64 is 20% of what number?

What per cent of:

9. 120 is 90?	10. 400 is 160?	11. 200 is 120?
12. 64 is 40?	13. 90 is 30?	14. 63 is 27?
15. 56 is 49?	16. 48 is 6?	17. 90 is 15?
18. 75 is $37\frac{1}{2}$?	19. 500 is 125?	20. 160 is 10?

21. If an article is bought for \$210 and sold at a gain of \$42, what per cent is gained?

22. A house is insured for \$4000 at $1\frac{3}{4}$% premium. Find the premium.

23. A man worth \$6000 bequeathed $33\frac{1}{3}$% of it to a hospital and divided the rest equally among his wife and three children. Find the share of each.

24. What per cent is gained by selling for \$3.00 a chair that cost \$2.50?

25. Can you lose 150% on an article? Can you gain 150%?

26. \$800 is $\frac{4}{5}$ of how many dollars?

27. \$800 is 80% of how many dollars?

1. By selling a piece of land for \$1600, a man lost 25%. Find the cost of the land. At what price should the land have been sold to have made 20%?

2. A man bought a house for \$2250 and sold it for \$2700. What per cent did he gain?

3. A house was insured for $\frac{3}{4}$ of its value at $\frac{3}{4}$%. If the premium was \$13.50, what was the value of the house?

4. An agent collected 80% of a debt of \$5600 and charged $4\frac{1}{2}$% commission. How much ought he to return to his employer?

5. A man paid \$25 for an insurance policy on his house. If the rate was $\frac{1}{2}$%, for how much was the house insured?

6. Find the interest on \$769.74 for 3 yr. 9 mo. at 4%.

7. An ocean steamer cost \$1,550,000. What premium must be paid to insure it at $2\frac{1}{4}$%?

8. The selling price of an article was \$73.50 after discounts of 30% and 30% had been made. What was the list price?

9. A commission merchant sold 500 pieces of cloth for \$130 a piece, and paid his employer \$55,250. What was his commission? What was the rate of his commission?

10. Find the cost of insuring a house for \$4000 at 60¢ on a thousand, and furniture for \$12,000 at 80¢ on a thousand, less a discount of 15% on each premuim.

11. A grain elevator in Minneapolis is valued at \$24,000 and the grain in it at \$25,000. The elevator is insured for $\frac{5}{6}$ of its value at $\frac{3}{4}$% and the grain is insured for $\frac{4}{5}$ of its value at $\frac{1}{2}$%. Find the entire premium..

12. A merchant paid \$1.50 for a book and marked it to be sold for \$2.00. If he discounted $12\frac{1}{2}$% from his marked price, how much did he gain?

13. An agent sold 165 bales of cotton, each bale weighing 380 lb., at 13¢ a pound, on a commission of $3\frac{1}{4}$%. What was his commission?

1. A man gained $16\frac{2}{3}\%$ by selling his horse for \$105. Find the cost of the horse.

2. If 4 lb. of cheese cost 48¢, how much cheese can you buy for 3 cents?

3. What per cent is lost on goods sold at $\frac{3}{4}$ of their cost? At $\frac{5}{8}$ of their cost? At $\frac{5}{6}$ of their cost? At half price?

4. A man is 72 years old, and $12\frac{1}{2}\%$ of his age is 25% of his son's age. What is the son's age?

5. When 100 shares of R. R. stock are sold for \$17,650, what is the price of one share?

6. If you had \$2 in the morning, but spent during the day 35 cents, a half-dollar, a quarter, and a dime, how much money would you have at night?

7. What day of what month is the 75th day of every year not a leap year? What change does leap year make?

8. What effect is made on an integer by annexing a cipher? By dropping a cipher?

9. What effect is made on a decimal by annexing a cipher? By prefixing a cipher?

10. What change is made in a decimal by moving the point one place to the right? By moving the point one place to the left?

11. The quotient is 45. What would the quotient be if the dividend was multiplied by 2?

12. The quotient is 9. What would the quotient be if the divisor was multiplied by 3?

13. The quotient is 12. What would the quotient be if the divisor was $\frac{1}{6}$ of what it is now?

14. The quotient is 17. What would the quotient be if both dividend and divisor were multiplied by 5?

15. The quotient is 21. What would the quotient be if both divisor and dividend were divided by 7?

16. An article that cost \$40 was sold for \$45. What was the gain per cent?

The questions have been omitted from the problems in this lesson that the pupils may gain power in determining, first, what can be found from given data and, second, *how* to find it. Do not ask the questions for the pupils. Lessons designed for this purpose will be marked simply statements.

1. A mowing machine was sold for \$36 at a loss of 25%.

2. A house was sold for \$2500, at a gain of 25%.

3. A pile of wood is 18 ft. 6 in. long, 4 ft. wide, and 7 ft. 9 in. high. It cost \$8 a cord.

4. Working on a commission of $2\frac{1}{2}\%$, an agent sold 400 bales of cotton, each weighing 480 lb., at 32¢ a pound.

5. A house which cost \$4800 rents for \$24 a month. The expenses on it are \$48 annually.

6. The selling price of an article was \$125.45, and the profit was $8\frac{1}{3}\%$.

7. A dealer sold a horse at $12\frac{1}{2}\%$ loss, and lost \$25.

8. A dealer lost 16% by selling goods for \$4200.

9. A man spent $\frac{8}{21}$ of his money, and invested $\frac{4}{15}$ in business. He had \$1850 left.

10. A flower bed is in the form of a semi-circle. Its radius is 24 ft.

11. A rectangle 150 ft. by 120 ft. has in the center a rectangular grass plot 80 ft. by 60 ft. The rest is covered with gravel 8 in. deep at 5¢ a cubic foot.

12. A bill of goods amounting to \$1000 was sold at discounts of 27% and 10%.

13. After deducting his commission of 5%, an agent returned to his employer \$1436.40.

14. \$468 was on interest at $4\frac{1}{2}\%$ for 5 yr. 9 mo.

15. If the divisor were one third what it is, the quotient would be 948.

16. A bin $8\frac{1}{2}$ ft. by 6 ft. by 5 ft. is $\frac{3}{4}$ full of oats. They are worth 36¢ a bushel.

17. The area of a triangle is 540 sq. ft., and the altitude is 108 ft.

1. If $\frac{1}{4}$ yd. of cloth costs $1\frac{1}{2}$ cents, what will 12 yd. cost?

2. If 3.5 acres cost \$35, what will 40 acres cost?

3. A man sold an automobile for \$180 less than it cost him and lost 20%. What did the automobile cost?

4. A dealer sold a harness for \$48. If this was 20% below cost, find the cost.

5. A boy had 48 cents and spent $\frac{4}{6}$ of it. How many cents had he left?

6. If a horse travels 6 miles an hour, how far will he travel in $4\frac{2}{3}$ hours?

7. A store is insured to the amount of \$5000, at $1\frac{1}{2}$%. What is the premium?

8. A man sold $\frac{1}{4}$ of his farm. Afterwards he bought 13 acres and then had 43 acres. How many acres were in the farm at first?

9. At 7%, find the interest on \$40 for a year.

10. Two men can do a piece of work in 3 days. If one man can do it in 5 days, in how many days can the second man do it?

11. A is 30 ft. ahead of B, but B runs 5 ft. while A runs 2 ft. How many feet will B run to overtake A?

12. A pedler bought potatoes at 60¢ a bushel, and sold them at 25¢ a peck. What was his gain per cent?

13. What is the least common multiple of 8, 12 and 24?

14. A farmer sold his wheat for \$267, and his oats for \$234. How much did he receive for both?

15. If $3\frac{2}{5}$ bbl. of flour cost $\$20\frac{2}{5}$, what will $6\frac{4}{5}$ bbl. cost?

16. What kind of numbers can be subtracted?

17. What is the result of an example in subtraction called?

18. When fractions are unlike, what must be done before subtracting?

19. A merchant sold a chair for \$3.60, which was 150% of its cost. What was the cost?

1. Find the net price of 15 reams note paper at \$1.25 and 25 reams letter paper at \$1.75 with 30% and $12\frac{1}{2}$% off.

2. Change $\frac{1}{16}$ of a mile to rods.

3. A tank 18 ft. long and 15 ft. wide, requires 96 sq. yd. of lead to line the sides and bottom. How deep is it?

4. Multiply seventy-eight ten-thousandths by five hundredths, and divide the product by thirteen thousandths. Reduce the quotient to a common fraction.

5. The fore-wheels of a carriage are $10\frac{1}{2}$ ft. in circumference and the hind-wheels 14 ft. How many more revolutions will one make than the other in going $\frac{1}{2}$ mile?

6. What will it cost to dig a cellar 72 ft. long, 35 ft. wide, and 6 ft. deep, at $62\frac{1}{2}$¢ a cubic yard?

7. Find the interest on \$2862 for 93 days at 6%?

8. Add: .96; 7.3004; 8010; .00093; 1.2465.

9. From 10.101 take 1.0999.

10. A field in the form of a trapezoid contains $11\frac{1}{4}$ acres. If the parallel sides are 60 rd. and 40 rd., what is the width of the field?

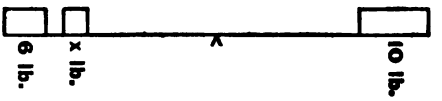
11. A stand-pipe is 30 ft. in diameter and 80 ft. high. How many square feet of sheet iron did it take to make it? How much will it cost to paint the convex surface at 28¢ a square yard?

12. A bin is 10 ft. long, 8 ft. wide, and $6\frac{1}{2}$ ft. deep. If it is $\frac{3}{4}$ full of wheat, how many bushels of wheat are there?

13. How many board feet are there in 14 beams 15 ft. long, 16 in. wide, and 9 in. thick?

14. A lawn tennis court is 78 ft. long and 27 ft. wide. At each end there is a margin of grass 12 ft. wide, and at each side a margin 6 ft. wide. It cost 50¢ a square yard to turf the margins and 35¢ a square yard to gravel the court. Find the entire cost.

15. A wagon upon which 4-ft. wood was piled was 12 ft. long. How high was the wood if there were $2\frac{1}{2}$ cords?



1. We see that the x weight must weigh 4 lb. in order that the two may balance the 10 lb. weight.

2. This may be written x lb. + 6 lb. = 10 lb. or $x + 6 = 10$. This is called an **equation.** $x + 6$ is the **first member,** and 10 is the **second member.**

3. You learned last year that the equality is not changed when:

a. The same number is added to both members.

b. The same number is subtracted from both members.

c. Both members are multiplied by the same number.

d. Both members are divided by the same number.

a.
$$\begin{array}{rl} x - 5 &= 8 \\ 5 &= 5 \\ \hline x &= 13 \end{array}$$
By adding 5 to both members we get rid of the negative 5 in the first member.

b.
$$\begin{array}{rl} x + 2 &= 10 \\ 2 &= 2 \\ \hline x &= 8 \end{array}$$
In this equation we wish to get rid of the positive 2, so we subtract 2 from both members.

c.
$$\begin{array}{rl} \frac{1}{2}x &= 5 \\ x &= 10 \end{array}$$
In this equation we wish to get rid of the fraction, so we multiply both members by 2. $2 \times \frac{1}{2}x = x$. $2 \times 5 = 10$.

d.
$$\begin{array}{rl} 3x &= 15 \\ x &= 5 \end{array}$$
We know the value of $3x$. We wish to know the value of x, so we divide both members by 3.

Find the value of x in the following and state which of the four rules above you used:

4. $x - 3 = 9$	5. $x + 5 = 12$	6. $x + 4 = 8$
7. $\frac{1}{3}x = 5$	8. $7x = 21$	9. $\frac{1}{2}x = 6$
10. $x - 7 = 4$	11. $x + 5 = 11$	12. $x - 2 = 6$

1. Charles and Henry together had 72 cents. If Charles had 3 times as many as Henry, how many did each have?

Let x = No. cents Henry had.
then $3x$ = No. cents Charles had.
and $x + 3x = 72$ cents.
$4x = 72$ cents.
$x = 18$ cents, that Henry had.
$3x = 54$ cents, that Charles had.

Always let x stand for the number that you need to know most in order to find other numbers depending upon it. Study the solution until you understand each step and know why each equation is given.

2. A farmer sold a horse and cow for $240. He sold the horse for 5 times as much as the cow. How much did he receive for each?

3. Divide 25 into two parts, so that one part shall be $\frac{2}{3}$ of the other part.

(1) Let x = larger part.
(2) then $\frac{2}{3}x$ = smaller part.
(3) then $x + \frac{2}{3}x = 25$
(4) $3x + 2x = 75$
(5) $5x = 75$
(6) $x = 15$. $\frac{2}{3}x = 10$.

If x is one part and $\frac{2}{3}x$ is the other part, then the 2 parts together will equal the number 25. What rule do you apply to change the third equation to the fourth?

4. Three-sevenths of a certain number exceeds $\frac{1}{4}$ of the same number by 25. What is the number?

Let x = the number.
then $\frac{3}{7}x - \frac{x}{4} = 25$
$12x - 7x = 700$
$5x = 700$
$x = 140$

In this example, to get rid of the fractions we must multiply both members by 28, the least common multiple of the denominators.

5. After a boy had spent $\frac{1}{4}$ and $\frac{1}{5}$ of his money he had $1.32. How much money had he at first?

6. A horse was sold for $96 at a gain of 20%. Find the cost of the horse.

Let x = cost of the horse.
$\frac{20}{100}x$ or $\frac{x}{5}$ = the gain.
then $x + \frac{x}{5} = \$96$.

1. A general placed 4800 men in 3 regiments so that the 2d regiment had twice as many as the 1st regiment and the 3d regiment had as many as both the others. How many men were placed in each regiment?

2. If you add 14 to 3 times a certain number, you will obtain 32. What is the number?

3. A, B, and C, earned \$8580. A earned twice as much as B and B earned four times as much as C. How much did each earn?

4. What number increased by $\frac{1}{2}$ of itself will equal $37\frac{1}{2}$?

5. What number increased by $\frac{1}{2}$ and $\frac{1}{5}$ of itself will equal 34?

6. What number increased by $\frac{1}{3}$ and $\frac{1}{4}$ of itself will equal 38?

7. What number diminished by $\frac{2}{5}$ and $\frac{3}{7}$ of itself equals 210?

8. What number must be added to $\frac{2}{3}$ of itself that the sum may be 55?

9. Esther is $\frac{1}{3}$ as old as Jessie, and the sum of their ages is 20 years. What is the age of each?

10. The sum of two numbers is 16 and their difference is 2. What are the numbers?

11. Thomas has 9 more marbles than John and together they have 35 marbles. How many marbles has each?

12. What number must be added 3 times to itself that the sum may be 160?

13. A boy lost $\frac{4}{5}$ of his marbles and had 35 marbles left. How many had he at first?

14. If $\frac{1}{2}$ of a number is added to $\frac{1}{4}$ of the same number, the sum will be 36. What is the number?

15. Divide 27 into three parts, so that the first shall be 5 greater and the second 5 less than the third.

16. The perimeter of a rectangle is 42 inches. If it is twice as long as it is wide, how long is it?

1. Compare 9 with 3. Compare $\frac{1}{2}$ with $\frac{1}{4}$.

2. The comparison of one object or quantity with another object or quantity of the same kind is called **ratio.**

3. Ratio is found by dividing the first number by the second, and is expressed in three ways:

a. By the sign of division, as $9 \div 3$.
b. By the colon, as 9: 3, read 9 is to 3.
c. By a fraction, as, $\frac{9}{3}$.

4. The first term of a ratio is called the **antecedent** and the second term is called the **consequent.**

5. What is the ratio of 18 to 9? 35 to 7? 16 to 4? 5 to 15? 9 to 12? 16 to 24?

6. 48 is the antecedent and 8 is the consequent. What is the ratio?

7. 12 is the consequent and 5 is the ratio. What is the antecedent?

8. 36 is the antecedent and 3 is the ratio. What is the consequent?

9. What kind of numbers can be compared?

10. When is the ratio a fraction? When is it an integer?

11. What is the ratio of .27 to .3? .12 to .2? .5 to .25?

12. Divide 64¢ between 2 girls in the ratio of 3 to 5.

$\frac{3}{8}$ of $64¢ = 24¢$
$\frac{5}{8}$ of $64¢ = 40¢$

Each time you give one girl 3¢, you must give the other 5¢. Hence the first girl has 3¢ out of every 8¢, or $\frac{3}{8}$ of the money, and the second girl must have $\frac{5}{8}$ of it.

13. Divide \$1.21 between 2 boys in the ratio of 5 to 6.

14. Divide 45 marbles between 2 boys in the ratio of 7 to 8.

15. There are 45 children in room 9, and the number of boys is to the number of girls as 5 is to 4. How many girls are there?

16. If $\frac{1}{2}$ in. on a map represents a distance of 50 miles, how many miles will $1\frac{1}{2}$ in. represent?

1. What is the ratio of 9 to 3? What is the ratio of 12:4?

2. These two ratios being equal may be written:

9:3 = 12:4. It may be read in 2 ways: The ratio of 9 to 3 equals the ratio of 12 to 4, or, 9 is to 3 as 12 is to 4.

3. **Proportion** is an equality of ratios.

4. In the proportion 9:3 = 12:4, name the antecedent of each ratio. Name the consequent of each ratio.

5. In every proportion the first and fourth terms are called the **extremes.** The second and third terms are called the **means.**

6. 9:3 = 12:4. Name the extremes and means in this proportion. Multiply the extremes together. Multiply the means together. Compare the two products.

Learn: In every proportion the product of the means equals the product of the extremes.

7. Either extreme equals the product of the means divided by the other extreme, as $8:4 = 6:x$. $8x = 24$. $x = 3$.

8. Either mean equals the product of the extremes divided by the other mean, as, $9:3 = x:4$. $3x = 36$. $x = 12$.

Find the missing term in each proportion:

9. $x:2 = 8:4$ 10. $10:2 = 15:x$

11. $14:x = 10:5$ 12. $15:5 = 12:x$

13. If 3 tons of coal cost \$16, how much will 6 tons cost?

3 tons : 6 tons = \$16 : \$$x$
$3x$ = \$96
x = \$32

A. Let x = the cost of 6 tons and write the ratio \$16 : \$$x$. Since the quantity of coal is directly proportional to the money expended, we write our first ratio 3 tons (that cost \$16):6 tons (that cost \$$x$).

B. Put \$$x$ in the fourth place. Since we are seeking for cost we put \$16 in the third place, because the third and fourth terms form a ratio and must be of the same kind. We know that 3 tons cost \$16 and that 6 tons will cost *more* dollars. This shows us that the consequent of our second ratio will be larger than its antecedent, therefore to have an equality of ratios we must make the consequent of our first ratio larger than its antecedent.

1. If 5 men can do a piece of work in 13 days, in how many days can 65 men do it?

A. Analysis.

5×13 days $= 65$ days.

$\frac{1}{65}$ of 65 days $= 1$ day.

Since 5 men can do the work in 13 days, 1 man can do it in 5×13 days or 65 days. Since 1 man can do the work in 65 days, 65 men can do it it in $\frac{1}{65}$ of 65 days or 1 day.

B. Proportion.

$65 \text{ men} : 5 \text{ men} = 13 \text{ d.} : x\text{d.}$

$$\frac{5 \times 13}{65 \times x} = 1 \text{ day.}$$

In arranging your proportion use either method given in the preceding lesson. This is an example of *inverse* proportion. In solving use cancelation.

Solve the problems in this lesson by analysis and by proportion:

2. If a quantity of provisions will last 630 men in a garrison 108 days, how long will the same quantity last 210 men?

3. If $1\frac{1}{5}$ yd. cost $\$1\frac{3}{4}$, what will 81 yd. cost?

4. If $6\frac{1}{2}$ cd. of wood cost \$28.60, how much can be bought for \$514.80.

5. If 24 lb. of butter can be made from 360 qt. of milk, how much milk will be required to produce 100 lb. of butter?

6. If $5\frac{1}{2}$ bu. of wheat cost \$4.95, how many bushels can be bought for $\$121\frac{1}{2}$?

7. If 20 men earn \$1280 in 8 days, how much can 36 men earn in the same time? How much can they earn in 24 days? In problems like this use your answer for the first part, in solving the second part.

8. If $8\frac{1}{4}$ tons of coal cost $\$37\frac{1}{8}$, what will $27\frac{1}{2}$ tons cost?

9. The wages for 20 men for 12 weeks are \$870. What are the wages of 8 men for the same time? Find the wages of 8 men for 4 weeks.

10. If 7 men can build $6\frac{3}{4}$ rd. of wall in $15\frac{1}{2}$ days, in how many days can 14 men build the same wall? How many rods could 14 men build in $15\frac{1}{2}$ days?

11. If $5\frac{7}{8}$ yd. of cloth cost \$4.70, what will $17\frac{5}{8}$ yd. cost?

1. Divide 36¢ into parts proportional to 3, 4, and 5.

Let $3x$, $4x$, and $5x$ = the parts.
Then $3x + 4x + 5x = 36¢$.
$12x = 36¢$ $x = 3¢$.
$3x = 9¢$ $4x = 12¢$ $5x = 15¢$.

2. Two men gained \$1100 in business. If they divided this in the proportion of 4 to 7, find the share of each.

3. Two men received \$65 for a piece of work. If one man worked 7 days and the other 6 days, how should the money be divided between the two men?

4. Divide \$4680 among three partners so that their shares shall be in the proportion of 2, 3, and 4.

5. An association of two or more men in business is called a **partnership.** The association is called a **firm** or **company.** The persons so associated are called **partners.**

6. Since gains and losses of a firm are shared in proportion to the amount of capital invested by each partner, partnership is only one form of proportion.

7. Three men purchased a store paying as follows: A, \$2000; B, \$4000; C, \$3000. Divide the gain of \$1800 between the three men.

\$2000 + \$4000 + \$3000 = \$9000, the whole capital.
A's share of the capital is $\frac{2000}{9000} = \frac{2}{9}$
Hence A's share of the gain must be $\frac{2}{9}$ of \$1800 = \$400. Find B's and C's shares in the same way.

8. Three men bought a house for \$5000. A paid \$1000, B, \$2400, and C, \$1600. If they rent it for \$600 a year, find each one's share of the rent.

9. Two men rent a farm for \$20.40. The first pastured 32 cattle and the second 36 cattle. How much should each man pay?

10. Three boys hire a bicycle for \$48. The first boy uses it 4 weeks, the second 5 weeks, and the third 3 weeks. How much should each boy pay?

1. Find 50% of 600 yd. $8\frac{1}{3}\%$ of 72 bu. 40% of 80 tons. 5% of \$40.

2. What are the terms of a ratio called?

3. What is the area of a rectangle whose base is 15 ft. and altitude 12 ft?

4. If 10 tons of coal cost \$55, what will 12 tons cost?

5. The goods in a store are worth \$3000, and are insured for $\frac{2}{3}$ of their value at $\frac{1}{2}\%$ premium. What will be the owner's loss if the goods burn? What will be the loss of the insurance company?

6. If $\frac{1}{2}$ of a number is added to itself the sum will be 30. What is the number?

7. If $\frac{1}{3}$ of a number is added to itself the sum will be 24. What is the number?

8. A man who has failed in trade is able to pay only 62¢ on a dollar. If he owes your father \$100, how much will your father lose?

9. If 3 men earn \$18 in a week, how many dollars will 4 men earn in a week? How many dollars will 4 men earn in 5 weeks?

10. Two men are 124 miles apart and traveling toward each other. If one travels 28 miles a day and the other 34 miles a day, in how many days will they be together?

11. If the two men in example 10 are traveling in the same direction, in how many days will they be together?

12. If 3 oranges cost 6 cents, what will a dozen oranges cost?

13. Three times 10 and $\frac{3}{5}$ of 10 are how many?

14. State example 13 in another way.

15. If 3 men can do a piece of work in $7\frac{7}{9}$ days, how long will it take 7 men to do it?

16. $5\frac{3}{7}$ is $\frac{1}{3}$ of what number? $8\frac{5}{9}$ is $\frac{1}{5}$ of what number?

17. At 20¢ a dozen, what will 18 eggs cost? What will 30 eggs cost?

1. A milkman bought an 80-quart can of milk at \$.15 a gallon, and sold it for \$4.80. What was his per cent of profit?

2. A man paid \$6.75 for coal at \$4.50 a ton. What part of a ton had he used when he had used $33\frac{1}{3}\%$ of the quantity bought?

3. How many square feet of sod can be removed from a field containing $\frac{1}{2}$ of an acre? If the sod is 3 in. thick, how many cubic feet of sod can be removed?

4. A garden whose breadth is 4 rd. and length $2\frac{1}{2}$ times its breadth has a wall 2 ft. thick, and 3 ft. high round it, outside of the boundary line. Find the cost of the wall at 5¢ a cubic foot by exact measurement.

5. How many yards of carpeting 27 in. wide will be required for a room 27 ft. 6 in. by 20 ft. 6 in., if the breadths run lengthwise and there is a loss of 9 in. on each breadth for matching?

6. A cubical cistern measures 9 ft. How many gallons of water will it hold? How many square feet of sheet iron will it take to line it?

7. Find the interest on \$1647 from Sept. 13, 1910, to July 21, 1912, at $4\frac{1}{2}\%$.

8. Estimate the number of bricks required for the walls of a building $80' \times 50' \times 22'$, if the walls are $1\frac{1}{2}$ ft. thick, and if 500 cu ft. are allowed for doors and windows.

9. What is the height of a pile of wood containing 50 cords, if it is 400 ft. long and 4 ft. wide?

10. What is the difference between a discount of 20% and 20%, and one of 25% and 15%, on a bill of goods amounting to \$1500?

11. Divide \$102,375 between A and B in the proportion of 10 to 11.

12. A's capital is \$6750 and B's is \$4780. If the gain is \$1153, find each one's share.

1. A tree 45 ft. high was broken at such a point that the part broken off was 4 times the length of the part left standing.

2. Goods marked \$64 were sold at $6\frac{1}{4}\%$ discount and 5% off for cash.

3. A commission merchant sold some goods for \$5728 and sent \$5656.40 to his principal.

4. A horse and buggy are worth \$300. The horse is worth 4 times as much as the buggy.

5. If the divisor were $\frac{1}{3}$ what it is, the quotient would be 948.

6. A merchant sold some cloth at \$1.19 a yard and lost 15%.

7. The merchant in example 6 marked the cloth so as to gain 15%.

8. An agent sold goods on 2% commission and remitted to his employer \$4777.50.

9. A man sold an automobile for \$931, thereby losing 5%.

10. The ceiling of a room 15 ft. 6 in. long, and 12 ft. 6 in. wide was painted at 16¢ a square foot.

11. A park 9 rd. square has a walk 9 ft. wide round it.

12. A man bought 20 sheep for \$250 and 20 cows for \$1050. He sold the sheep at a gain of $12\frac{1}{2}\%$ and the cows at a gain of $7\frac{1}{2}\%$.

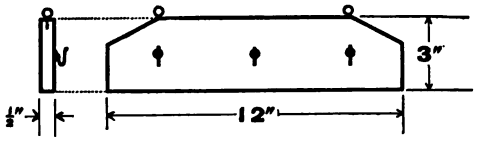
13. A man insured his house for $\frac{3}{4}$ of its value at $\frac{2}{3}\%$. The premium was \$24.

14. A number increased by 22% of itself is 23,546.

15. A pile of wood contains 12 cords. It is 32 ft. long and 4 ft. wide.

16. The product of three numbers is 3135. One of the numbers is $28\frac{1}{2}$, and another is 22.

17. By selling butter at 30¢ a pound on 4% commission, an agent received \$72.

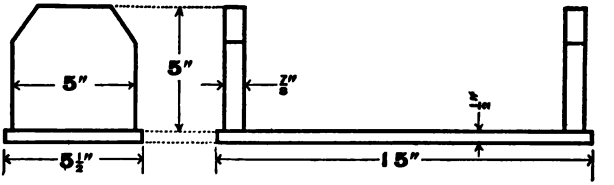


1. What part of a board foot does it take to make the keyboard shown in the drawing?

2. How many board feet will furnish sufficient material for a class of 24 boys?

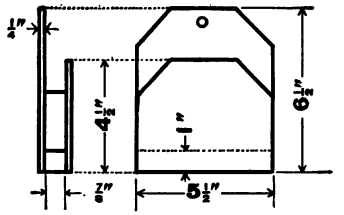
3. The keyboards are made from white-wood which costs 10¢ a board foot. Find the cost of lumber required for the class.

4. Allowing $2\frac{1}{2}$ cents for the hooks and screw rings used on each board, find the cost of each keyboard when completed.

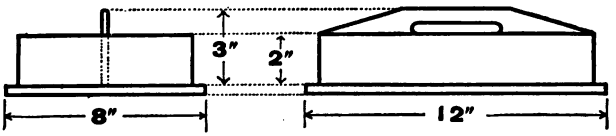


5. From the drawing find each dimension. Add one inch to each linear dimension as an allowance for waste in cutting, and, assuming that all pieces will be cut from stock 6″ wide, find how many board feet of lumber will be required for a class of 24 boys.

6. If this book rack is made from California Bay-wood, which costs $300 per thousand feet, find the cost of lumber for each book rack. Find the cost for the class.



7. From the drawing find each dimension. Add one-half inch to each linear dimension and find the amount of lumber needed for 24 boys each to make a letter holder.



1. This knife and fork box is made of $\frac{1}{4}$″ white-wood. Find the dimensions and the area of the bottom board.

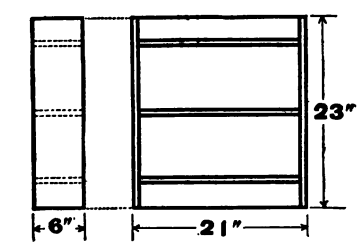
2. The bottom board projects $\frac{1}{2}$″ beyond the sides all the way round. Find the length of each side.

3. The sides are nailed to the ends. Find the length of the ends.

4. In cutting up the lumber $\frac{1}{2}$″ is added to the length of each piece to allow for squaring. How long a piece will be required to make the sides and ends?

5. The handle is cut from a piece $\frac{1}{4}$″ × 3″ × 12″. Find how many board feet will be needed to allow each boy of class of 24 to make the box.

6. If the lumber costs $40 per M, find the cost of the material for the class.



7. Add 1″ to the length of each piece for squaring. Find the dimensions of the board from which the end piece can be cut.

8. The cabinet is made of $\frac{1}{2}$″ white-wood. Find the length of each shelf when finished. Making allowance as in example 7, what must be the length of the piece from which the three shelves are made?

9. The back is made from matched boards 3 in. wide. How many boards will be needed?

10. Find the number of board feet required for one of the cabinets. For 24 cabinets.

The following tables, taken from the U. S. Department of Agriculture, give a menu for one day for a family of 4 adults.

BREAKFAST

	Lb.	Oz.	Cost
Corn meal in mush and cake	0	5	1¢
Milk	0	6	1¢
Sugar	0	2	½¢
Toast	0	10	2½¢
Butter	0	2	3¢

DINNER

	Lb.	Oz.	Cost
Beef roll	3	0	15¢
Potatoes	1	8	2¢
Beets	0	8	1¢
Bread	0	10	2½¢
Butter	0	2	3¢

SUPPER

	Lb.	Oz.	Cost
Baked beans	2	10	6¢
Pork	0	12	6¢
Potatoes (fried)	1	8	2¢
Lard	0	2	1¢
Bread	0	10	2½¢
Butter	0	2	3¢

1. Find the total cost for three meals for the day.

2. Find the total cost for each man for the day.

3. At that rate per day what would the meals cost for the family for a week?

4. Find the total weight of the food consumed.

5. Find the average weight per man of the food consumed.

6. From the cost and weight of butter given, find the price per pound.

7. A bushel of potatoes weighs 60 lb. What part of a bushel was consumed? Find the estimated price of a bushel.

8. A certain family added to the above menu as follows: At breakfast broiled sirloin, 11¢; at dinner tomato soup, 6¢, apple dumpling, 8¢; at supper oranges, 7¢. Find the total addition to the above cost.

1. A family had an annual salary of $2500. They spent 30% for food, 15% for rent, 3% for fuel, 10% for wages, 10% for clothing, 5% for books and travel, 5% for charity and insurance. If they saved the rest how much did they save? Find the sum spent for food, rent, etc.

2. The next year the same family wished to have more money for books and travel and yet save the same amount. This year they spent 25% of their salary for food, 15% for rent, 3% for fuel, 10% for clothing, and 5% for charity and insurance. How much more money did they save for books and travel?

3. Find the cost of furnishing a bedroom, if the following articles were bought: Rug, $4.50; bed and spring, $6.50; mattress, $4.75; 2 pillows @ $2.50; 4 sheets @ $.75; 3 pairs of pillow cases @ $.50; 1 pair blankets, $4.00; 1 spread, $1.25; 1 bureau, $8.50; 2 chairs @ $2.00.

4. Find what per cent the cost would have been increased if the following articles had been purchased: 1 rocker, $3.75; 1 table, $6.00; 1 washstand, $4.75; 1 toilet set, $3.25; $\frac{1}{2}$ doz. towels, $1.60.

5. The following articles were bought for the dining-room: 1 rug, $8.00; 1 table, $13.50; 6 chairs @ $3.00; 1 side board, $12.19; 1 serving-table, $5.75; $2\frac{1}{2}$ yd. table linen, @ $1 a yard; $2\frac{1}{2}$ yd. table linen @ $1.20; 1 doz. napkins, $1.50; 1 doz. nakpins, $2.00; 2 tray cloths @ $.75 each. The cost of furnishing the dining-room was what per cent of the cost of furnishing the bedroom?

6. The dining-room table is 42 in. square. There are 3 extra leaves, each 10 in. wide. Give the dimensions of the table when the three leaves are used.

7. What must be the width and length of the table cloth to allow it to hang down 9 in. on each side?

8. The sheets had a 3-in. hem at the top and bottom and were $2\frac{3}{4}$ yd. long when finished. How many sheets could be made from $17\frac{1}{2}$ yd. of sheeting?

1. Three men, A, B, and C, formed a company with a capital of \$8000. B put in 4 times as much as A, and C 3 times as much as A. How many dollars did each put in?

2. The sum of 2 numbers is 99, and the greater is twice the less. What are the numbers?

3. Divide the number 88 into three parts, so that the second shall be 3 times the first, and the third 4 times the first.

4. Four men have together \$480. B has 4 times as much as A; C has 6 times as much as B, and D has $\frac{1}{3}$ as much as C. How many dollars has each?

5. A certain number added to 7 times itself equals 64. What is the number?

6. A company of 300 persons consists of men, women, and children. There are 2 times as many children as men, and 3 times as many women as men. How many women are there?

7. A man bought an equal number of lemons and oranges for \$6.25. For the lemons he paid 2¢ each, and for the oranges 3¢ each. How many of each did he buy?

8. The larger of 2 numbers is 5 more than the smaller, and their sum is 17. What are the numbers?

9. Divide 20 in two parts so that the larger part may be 4 more than the smaller part.

10. Anna is one-half as old as Mary, and the sum of their ages is 21. What is the age of each?

11. The difference between two numbers is 7, and their sum is 23. What are the numbers?

12. Three men are in business together. Divide their gain of \$9000 in the proportion of 3, 5, and 7.

13. Two men bought an automobile for \$2400. If one man paid \$3 to the other man's \$5, how much did each pay?

14. Separate 153 into parts proportional to 8 and 9.

1. Guess at the length of the room. Measure the length. How great a mistake did you make.

2. Walk the length of the room counting your steps. Find the length of your steps.

3. Estimating distances by counting the number of steps is called **pacing.** A pace is usually 3 feet. How much less than a pace was the length of your step?

4. Pace the width of the room. How many feet wide did you make it? Measure the width. How near was your estimate to the correct distance?

5. Make two marks on the floor 1 rod apart. Pace the distance until you can correctly estimate a rod, 2 rods, 3 rods, etc.

6. Cut a string 165 ft. long. How many rods long is it? Call this your measuring string.

7. Estimate by pacing the distance from one street to another. With your measuring string measure the distance, correcting your error if any.

8. Using your measuring string find some object 20 rd. from the schoolhouse. What part of a mile is it?

9. In the same way find an object that is 40 rd. distant. Find one that is 80 rd. distant. One that is 160 rd. distant. In each case tell what part of a mile it is.

10. Since the square rod is a common unit of measure, mark off on the floor a square rod. Study it closely till you have formed a mental picture of its size. This is called visualizing it.

11. Without measuring mark off in the yard a square rod. Measure it to correct your error.

12. In some park or vacant lot mark off a rectangle 16 rd. $\times$ 10 rd. or 20 rd. $\times$ 8 rd. This is 1 acre.

13. Without measuring estimate how much more or less than an acre of land there is in the school yard. Measure and see if you made any error.

TABLE OF U. S. MONEY

10 mills = 1 cent (¢)
10 cents = 1 dime
10 dimes = 1 dollar ($)
10 dollars = 1 eagle (E)

The standard of value in the U. S. is the dollar. The mill is not coined, but is expressed as a tenth of a cent. The coins of the U. S. are made of bronze, nickel, silver, and gold.

TABLE OF ENGLISH MONEY

4 farthings (far.) = 1 penny (*d*)
12 pence = 1 shilling (*s*.)
20 shillings = 1 pound (£)

The standard of value in England is the pound or sovereign. The farthing is not coined but is expressed as a fraction of a penny. The coins of England are made of copper, silver, and gold. The names and values of coins in Canada are the same as in the United States.

A shilling is equal to $.24 and a pound to $4.8665. In estimating equivalents we call the shilling 25¢ and the pound $5.

1. How many cents are there in 25 dollars? In 25 eagles?

2. How many pence are there in 25 shillings? In 25 pounds?

3. Change 144 pence to shillings. Change 80 shillings to pounds.

4. How many shillings are there in ½ sovereign?

5. Change £1 3*s*. to pence.

6. About what is the value of $100 in pounds sterling? What is its exact value in pounds and hundredths of a pound?

7. How much U. S. money will it take to pay a debt in London of £40 8*s*.?

Change £8 12*s*. 8*d*. to United States money.

12) 8. .
20)12.666+
£8.6333+

8*d*. = .666+ shillings. 12.666*s*. = .6333+ pounds. Hence £8 12*s*. 8*d*. equals £8.6333+. Since 1 pound equals $4.8665, 8.633 pounds must equal 8.6333 × $4.8665.

8.6333 × $4.8665 = $——.

Change to United States money:

8. £7 15*s*.
9. £15 10*s*. 6*d*.
10. £12 4*s*. 8*d*.
11. £20 10*s*.
12. £12 15*s*. 3*d*.
13. £75 5*s*. 1*d*.

1. Change \$115.50 to English money.

\$115.50 ÷ \$4.8665 = 23.733 +, the number of pounds.
.733 × 20*s.* = 14.66*s.* .66 × 12*d.* = 7.92*d.*
Hence \$115.50 = £23 14*s.* 8*d.*

2. Give the approximate equivalent in pounds of \$500.

Reduce to English money to the nearest penny:

3. \$7.25 4. \$36.15 5. \$120.10 6. \$2000

The standard of value in Germany is the *mark* which is equivalent in value to \$.2385, approximately \$.25.

7. Change 1000 marks to its exact equivalent in U. S. money. To its approximate equivalent.

8. A traveler carried \$238.50 to Berlin. When changed to marks, how many would he have?

9. A German laborer received 25 *pfennigs* an hour, and worked 9 hours a day for 30 days. His wages for the whole time is equivalent to how much U. S. money? 100 *pfennigs* equal a mark.

The standard of value in France is the *franc*, which is equivalent in value to \$.193, approximately \$.20. In Italy the standard of value is the *lira*, of the same weight and value as the franc.

10. Find to the nearest cent the value of 500 lira. Of 1500 francs.

11. Merchandise invoiced at 120 lira was imported from Italy. Find to the nearest cent its value in U. S. money.

12. The toll on vessels passing through the Suez Canal is $8\frac{1}{2}$ francs a ton. How many francs must be paid by a vessel carrying $3956\frac{1}{2}$ tons? Find its equivalent in U. S. money.

13. One dozen cloaks invoiced at 600 francs was received from Paris and 300 yd. of carpeting, invoiced at 6*s.* a yard, was received from London. Find to the nearest cent the value of all in U. S. money.

1. What is the area of a rectangle 40 ft. × 20 ft?

2. A lot measures 60 ft. by 120 ft. How many posts, 10 ft. apart, will be required for the fence for this lot?

3. How many strips of carpet 1 yard wide are needed for a floor 30 ft. × 18 ft., if the breadths run lengthwise?

4. How many yards long will each strip be? How many yards of carpet will be needed for the room?

5. How many acres are there in a field 80 rd. by 40 rd.?

6. What is a parallelogram?

7. Find the area of a parallelogram whose base is 40 ft. and whose altitude is 20 ft.

8. Define a triangle. Give the rule for finding its area.

9. Find the area of a triangle whose base is 4 ft. and altitude 4 ft.

10. The area of a triangle is 40 sq. ft. If the base is 10 ft., what is the altitude?

11. Define a trapezoid. Give the rule for finding its area.

12. The two parallel sides of a trapezoid are 20 ft. and 10 ft. If the altitude is 8 ft., what is the area?

13. The area of a trapezoid is 60 sq. ft. If the two parallel sides are 12 ft. and 8 ft., what is the altitude?

14. How can you find the diameter of a tree?

15. The radius of a bicycle wheel is 14 in. What is its circumference?

16. The circumference of a wheel is 88 in. What is its diameter?

17. State the steps necessary to take to find the area of a circle when you know its circumference.

18. What is π ?

19. State the dimensions of a cord of wood.

20. Without finding the number of cubic feet, find the number of cords in a pile of wood 16 ft. long, 4 ft. wide, and 4 ft. high.

1. Find the approximate difference in area between a field 40 rd. square and one 40 rd. in diameter. Find the exact difference.

2. Find the approximate difference in volume between two cisterns, one in the form of a cylinder 6 ft. in diameter and 6 ft. deep, and the other in the form of a 6-ft. cube.

3. What is the cost of digging a cistern in the form of a cylinder whose diameter is 6 ft., and whose depth is 18 ft., at 62¢ a cubic yard? How many gallons of water will this cistern hold?

4. A house is to be built 40 ft. by 30 ft. Estimate the number of bricks required for the walls, if the walls are 1 ft. in thickness and no allowance is made for openings.

5. The cellar of this house is 6 ft. deep and the walls are 16 in. thick, how many cubic feet of stone will be needed for the cellar wall?

6. At 18¢ a pound, $4\frac{1}{2}$ lb. to a square foot, find the cost of lead to line a tank 6 ft. by 5 ft., and $4\frac{1}{2}$ ft. deep.

7. How many bushels of potatoes can be put in a wagon-box 18 ft. long, 3 ft. wide, and 2 ft. deep?

8. Find the cost of the following bill of lumber at $18 per M:

200 boards, 16 ft. by 10 in. by 1 in.
150 boards, 12 ft. by 12 in. by 1 in.
40 planks, 12 ft. by 10 in. by 3 in.
20 scantling, 15 ft. by 4 in. by 2 in.

9. What will it cost to paper a room $24' \times 20' \times 10'$ with paper costing 20¢ a roll? There are 2 windows $5' \times 4'$ and a door $6' \times 4\frac{1}{2}'$.

10. At $175 an acre, what is the value of a triangular piece of land whose base is 64 rd. and the perpendicular distance from the base to the vertex is 32 rd.?

11. How many square inches of tin will be required to make 50 boxes 9 in. long, 4 in. wide, and $3\frac{1}{2}$ in. deep?

1. What number diminished by 10 and the remainder multiplied by 6 makes 36?

2. The sum of 3 numbers is 46. If two of them are 20 and 16, what is the third?

3. Of what number is 7 both divisor and quotient?

4. Of what number is 16 one of the three equal addends?

5. Of what number is 12 both subtrahend and remainder?

6. If 13 men earn $\$32\frac{1}{2}$ a day, how much will 52 men earn a day. What is the ratio of 52 to 13?

Find the value of x in the following:

7. $x + 3 = 8$.	8. $5x = 15$.	9. $\frac{1}{3}x = 7$.
10. $x - 3 = 5$.	11. $3x + 5 = 26$.	12. $\frac{2}{3}x = 4$.
13. $5 + x = 11$.	14. $2x - 4 = 16$.	15. $\frac{1}{4}x = 3$.

16. George and Tracy together have 24 marbles. George has 5 times as many as Tracy. How many has each?

17. In a school of 47 pupils there are 3 more boys than girls. How many boys are there?

18. Five times Elwood's age exceeds four times his age by 15 yr. How old is Elwood?

19. Divide 40 into two such parts that one shall be four times the other.

20. Find the gain and the rate per cent of the gain, when the cost is 48¢ and the selling price 52¢.

21. Find the gain and selling price, when the cost is \$20 and the rate of gain 25%.

22. Give the rules for multiplying and dividing decimals by 10, by 100, and by 1000.

23. Multiply and divide the following by 100: .75, .016, .2, .15, 2.36.

24. What is the difference between .0025 and .01?

25. Find the least common multiple of 2, 3, and 4.

26. What is the interest on \$800 for 2 yr. at 6%?

1. Find the joint effect of the following 3 forces: A, pulling forward $76\frac{1}{4}$ lb.; B, pulling forward $82\frac{1}{2}$ lb.; and C, pulling backward $84\frac{7}{8}$ lb. To what single force are the three forces equal?

2. A cubic foot of brass weighs 523.8 lb. Find its specific gravity by dividing by $62\frac{1}{2}$ lb. the weight of a cubic foot of water.

3. In £28 15*s*. there are how many shillings? Find the value in U. S. money.

4. How many tons are there in 14,200 lb.?

5. A platform was built to sustain a weight of 45 tons. On the platform is a pile of oak boards 20 ft. long, 10 ft. wide, and 8 ft. high. If the average weight is 54 lb. to each cubic foot, how much more weight could the platform sustain?

6. To what single rate of discount is a discount of 20% and 5% equivalent?

7. A rectangular wheat field is 40 rd. $\times$ 20 rd. The farmer reaps a swath $8\frac{1}{4}$ ft. wide round the field. How many square rods does he reap?

8. If he again reaps a swath $8\frac{1}{4}$ ft. wide round the field, how many rods does he reap the second time round? The third time round? The fourth time round?

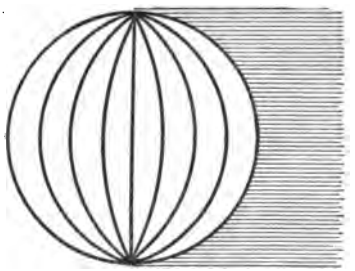
9. Make out a receipted bill for the following items:

May 1, 1910, Mr. J. R. Jones bought of Smith Bros., 14 yd. of silk, @ \$1.75; May 10, 58 yd. cotton @ 9¢; May 12, 10 yd. suiting @ \$2.25; May 18, 24 yd. carpet @ $87\frac{1}{2}$¢; June 3, 40 yd. matting @ 35¢; June 7, 5 pairs curtains @ \$5.75.

10. Define antecedent, consequent, proportion.

11. The antecedent is 150, and the consequent $37\frac{1}{2}$. What is the ratio?

12. If a man travels 48 mi. in 12 hr., how many miles can he travel in 60 hr. at the same rate?



1. From the globe or from this diagram notice the lines that extend from the North to the South Pole.

2. These lines are called **meridians**, that is the *lines of midday*.

3. We usually call the meridian that passes through the Royal Observatory at Greenwich, England, the *prime meridian*.

4. Distance east or west of the prime meridian measured in degrees is called **longitude**.

5. Repeat the table of circular measure. How many degrees are there in the circumference of the earth?

6. How long a time is required for the earth to rotate on its axis?

7. Every point upon the surface of the earth passes through 360° in 24 hours. Since this is true we say 24 hours of time correspond to 360°.

8. One hour of time corresponds to how many degrees? What is $\frac{1}{24}$ of 360°?

9. If 1 hour of time corresponds to 15°, then 1 min. of time corresponds to $\frac{1}{60}$ of 15° = $\frac{1}{4}$° = 15′. In the same way we find that 1 sec. of time corresponds to 15″ of longitude.

10. In what direction does the earth revolve? In what direction, then, does the sun *appear* to move?

11. Do places east or west of us see the sun rise first?

12. If the places east of us begin the day earlier, will they have earlier or later time than we have?

Learn: Places east of us have later time.
Places west of us have earlier time.

13. A is situated 15° east of B. When it is 12 M. at B, what time is it at A?

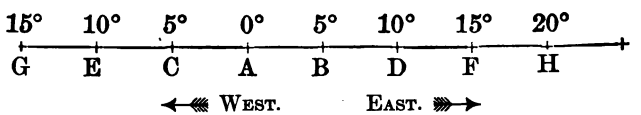
1. What is the difference in time of two places if the difference in longitude is 15°? 30°? 60°? 90°?

2. State a rule for finding the difference in time when the difference in longitude is known.

3. What is the difference in longitude between two places if the difference in time is 1 hour? 3 hours? $2\frac{1}{2}$ hours?

4. State a rule for finding the difference in longitude, when the difference in time is known.

5. When it is noon here, what time is at it a place 15° east of here? 30° west? 120° west? 90° east? 45° east? 15° 30′ west? 30° 15′ east?

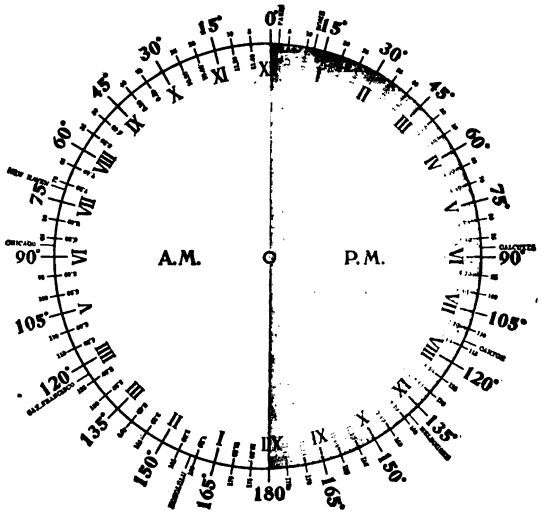


6. How far apart are A and D? How was it found?
7. How far apart are B and F? How was it found?
8. How far apart are A and C? How was it found?
9. How far apart are C and G? How was it found?
10. How far apart are B and C? How was it found?
11. How far apart are D and G? How was it found?

12. State a rule for finding the difference in longitude between two places when both are in east longitude? When both are in west longitude? When one is in east and the other in west longitude?

Find the difference in longitude between places situated at the following meridians :

13. 15° W. and 45° W.
14. 15° E. and 60° E.
15. 20° E. and 50° E.
16. 30° W. and 75° W.
17. 15° E. and 30° W.
18. 30° W. and 45° E.
19. 40° W. and 20° E.
20. 25° E. and 35° W.
21. 24° E. and 6° W.
22. 32° W. and 28° E.



This drawing was made from a chart used in solving problems in Longitude and Time.

DIRECTIONS FOR MAKING

a. Cut a circle having a 4-in. radius, and divide it into degrees.

b. Cut a circle having a 3½-in. radius, and divide it into 24 equal parts, to correspond with the hours in the day.

c. Fasten these two circles by an eyelet at the center so that one can revolve upon the other.

1. When it is 2 P.M. at A, 60° west longitude, what time is it at B, 90° east longitude?

A. Solution by using chart:

Turn the hour dial until 2 P.M., the time at A coincides with 60° W., the longitude of A. Find 90° E., the longitude of B, and on the hour dial read the corresponding time.

B. 60° + 90° = 150°.
150° ÷ 15° = 10. ∴ 10 hr.
2 P.M. + 10 hr. = 12 midnight.

First find the difference in longitude. Change it to difference in time by dividing by 15°. The difference in time is 10 hr. Since B, 90° E., is *east* of A, 60° W., its time must be *later*, and 10 hr. later than 2 P.M. is 12 midnight.

TABLE OF LONGITUDES

Amsterdam, 4° 53′ 4″ E.	New Orleans, 90° 3′ 28″ W.
Berlin, 13° 23′ 43″ E.	New York, 74° 0′ 3″ W.
Boston, 71° 3′ 30″ W.	Paris, 2° 20′ 22″ E.
Canton, 113° 16′ 30″ E.	Rome, 12° 27′ 14″ E.
Chicago, 87° 36′ 45″ W.	San Francisco, 122° 26′ 48″ W.
Manila, 120° 58′ 6″ E.	Washington, 77° 3′ 6″ W.

When it is noon at Paris, what time is it at Boston?

$$\begin{array}{r} 2^\circ\ 20'\ 22'' \\ 71^\circ\ \ 3'\ 30'' \\ \hline 15)73^\circ\ 23'\ 52'' \\ \hline 4\ \ 53\ \ 35 \end{array}$$

$\therefore$ 4 hr. 53 min. 35 sec.

$$\begin{array}{r} 12 - 0 - 0 \\ 4 - 53 - 35 \\ \hline 7 \text{ hr. } 6 \text{ min. } 25 \text{ sec.} \end{array}$$

One place being in east longitude and the other in west longitude, we add and find the difference to be 73° 23′ 52″. Since 15° of longitude makes a difference of 1 hr. in time, and 15′ of longitude makes a difference of 1 min. in time, we divide the difference in longitude by 15°, and find the difference in time to be 4 hr. 53 min. 35 sec. Since Boston is *west* of Paris, it must have *earlier* time, so we subtract 4 hr. 53 min. 35 sec. from 12 M. and find the time is 6 min. 25 sec. past 7 o'clock A.M.

When it is noon at New York, what is the solar time of:

1. Amsterdam?
2. New Orleans?
3. Berlin?
4. Boston?
5. Paris?
6. Rome?
7. Canton?
8. Chicago?
9. San Francisco?

10. When it is 3 P.M. at New York, what time is it in New Orleans?

11. When it is noon at Canton, what time is it at Washington?

12. When it is 6 A.M. at Chicago, what time is it at Rome?

13. When it is 9 A.M. at C, 120° W., it is 12 M. at D. Find the longitude of D.

A. Turn the hour dial until 9 A.M. coincides with 120° W., Find 12 M. and read the longitude on the corresponding dial.

B. 12 hr. − 9 hr. = 3 hr.
$3 \times 15^\circ = 45^\circ$
$120^\circ - 45^\circ = 75^\circ$ W.

First find the difference in time. Since 1 hr. in time makes a difference of 15°, we multiply 15° by 3 and find the difference in longitude is 45°. Since the time at D is *later* than the time at C, it must be east of it. When we are in west longitude and travel east, we are moving toward the prime meridian, and therefore subtract 45° from 120°.

14. When it is noon at Paris, what is the time at St. Petersburg, 30° 16′ E?

When it is 10 o'clock A.M. at Philadelphia, 75° 10′, it is 10 min. past 3 P.M. at Paris. What is the longitude of Paris?

15 hr. 10 min.	77° − 30′
10 hr.	75° − 10′
5 hr. 10 min.	2° − 20′ E.
15 min.	
75 − 150	
77° 30′	

3 P.M. is the 15th hour of the day. The difference in time is 5 hr. 10 min., which corresponds to 77° 30′ difference in longitude. Since Paris has *later* time than Philadelphia it must be 77° 30′ *east* of it. Since the prime meridian is only 75° 10′ east of Philadelphia, then Paris must be the difference between 77° 30′ and 75° 10′ east of the prime meridian.

1. A and B sailed together from New York. A kept his watch by New York time and B set his by the sun every day. In a few days the watches were 2 hr. 16 min. apart. Whose watch was the faster? In what longitude were they?

2. The longitude of Jerusalem is 35° 32′ E. When it is 7.30 A.M. at New York, what time is it at Jerusalem?

3. What change must a person make in his watch in going from Washington to Paris?

4. A is 45° 10′ east of B. What time is it at B, when it is 6 o'clock P.M. at A?

5. When it is noon at Greenwich it is 5 hr. 50 min. $26\frac{4}{5}$ sec. earlier at another place. From the table of longitudes, find the name of the other place.

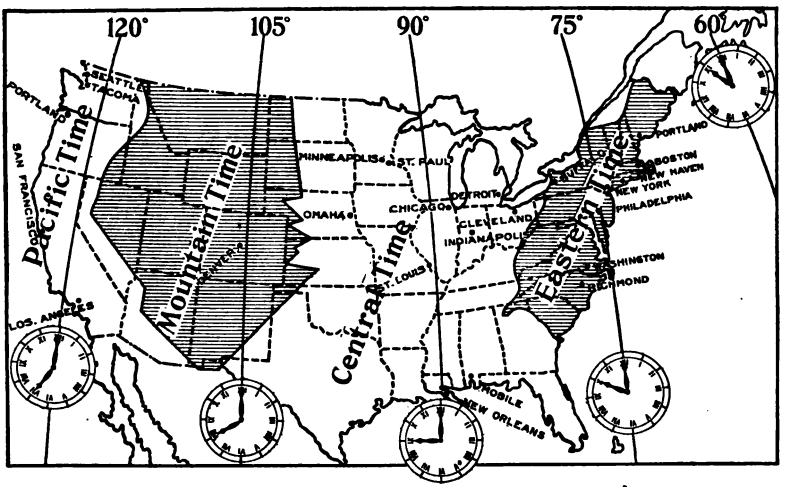
6. Suppose an account of an accident, that happened in Manila 120° E. at 5 A.M. Wednesday morning, was sent to New York with only a loss of one hour in transmission, at what time would it reach New York?

7. At what time will quotations of the stock exchange in Paris reach New York, if cabled at 1 P.M.?

8. A ship in distress reports by wireless telegraph that she is in longitude 45° 30′ west. If the message was sent at 10 A.M., when could the Boston station catch the message?

9. Allowing no time for transmission when could the New York papers receive dispatches sent at noon from Canton? Rome? Manila?

Standard Time



1. The difference in time between all places caused such inconvenience to the railroads and persons traveling that in November, 1883, the railroads of the United States and Canada adopted what is called Standard Time.

2. Four meridians were chosen, 15° apart, as central meridans. These are the 75°th, 90°th, 105°th, 120°th. It was intended that all places $7\frac{1}{2}$° on either side of these meridians should form a belt, but as a matter of fact the railroads found it necessary to change time at some convenient point. The result is very irregular boundaries for the belts.

3. These time belts are called Eastern, Central, Mountain, and Pacific.

4. When it is noon in the Central belt, what time is it in the Eastern? Mountain? Pacific?

1. In traveling from Boston to Minneapolis, what change will a traveler need to make in his watch?

2. What changes must a man make in his watch in traveling from San Francisco to Boston?

3. A train arrives in Buffalo at 1.15 P.M. It waits 15 min. and leaves at 12.30 P.M. Explain how this can be true.

4. When it is 12 M. at Baltimore, what time is it at San Francisco? At Denver? At New Haven?

5. How should a watch be changed in going from Connecticut to Minnesota? From California to Ohio?

6. What is the difference between the true time and the standard time at a place whose longitude is 85° W.? 125° W.

Give the difference in standard time, and tell which place has earlier time:

7. Boston and St. Louis.
8. Washington and Tacoma.
9. Portland, Me., and Seattle.
10. Richmond and Omaha.
11. Philadelphia and Chicago.
12. Los Angeles and St. Paul.
13. Mobile and Portland, Or.

14. How should a watch be changed in going from New York to St. Louis? From Chicago to Washington?

15. When it is 1 P.M. at Baltimore, what time is it at Indianapolis? At Denver?

16. A panic on the stock exchange in New York was reported by telegraph to Cleveland, San Francisco, Boston, New Orleans, Minneapolis, and Buffalo. Allowing 10 min. for transmission, when did the message reach each city?

17. When it is 2 P.M. in Texas, what time is it in Maine? California? Florida? Minnesota?

1. If 5 bbl. of flour cost \$20, what will 25 bbl. cost?

2. The divisor is 7¢, the quotient 9, and the remainder 2¢. What is the dividend?

3. The remainder is \$15, and the subtrahend \$42. What is the minuend?

4. The product is \$80 and the multiplier is 5. What the multiplicand?

5. The product is \$120 and the multiplicand \$40. What is the multiplier?

6. The divisor is 15, the quotient is \$5, and the remainder \$2. What is the dividend?

7. If 9 yd. of muslin cost \$1.08, what will 7 yd. cost?

8. How many pecks are there in 6 bu. 3 pk.?

9. Change 4 hr. 35 min. to minutes.

10. Change 4° 20′ to minutes.

11. A city lot contains 6000 sq. ft. If it has a 50-ft. front, how deep is the lot?

12. A room is 15 ft. by 20 ft. What is its perimeter? If the room is 10 ft. high how many square feet are there in its walls? How many square feet are there in the walls and ceiling?

13. A box that is 10 in. long and 4 in. wide, contains 240 cu. in. How deep is the box?

14. The sum of two numbers is 35 and the smaller is 15. What is the larger number?

15. How many days are there from May 5 to June 15?

16. A man receives \$2.40 a day and his boy $\frac{1}{4}$ as much. What will both earn in 2 weeks?

17. An automobile averages 15 mi. an hour. How far will it go in 5 days of 10 hr. each?

18. When it is noon at New Haven, what time is it at a place 45° east of it? 60° west? 90° east? 120° west?

19. Change: $7\frac{3}{4}$ to fourths; $3\frac{3}{8}$ to eighths; $12\frac{1}{3}$ to thirds.

1. How many feet board measure are there in 48 boards, $\frac{7}{8}$″ thick, 4″ wide, and 15′ long?

2. Change to whole or mixed numbers: $\frac{242}{69}$, $\frac{153}{55}$, $\frac{196}{13}$, $\frac{551}{17}$.

3. Change to improper fractions: $47\frac{2}{3}$, $96\frac{11}{12}$, $13\frac{7}{19}$, $41\frac{27}{100}$.

4. Find the product of $\frac{14}{50} \times \frac{75}{91}$. $22 \times 6\frac{7}{11}$. $\frac{7}{8} \times \frac{8}{15} \times \frac{25}{2}$.

5. $89\frac{3}{5}$ is $\frac{14}{25}$ of what number?

6. Find the sum of $\frac{8}{15}$, $\frac{7}{10}$, $\frac{5}{8}$, $\frac{6}{25}$.

7. From $41\frac{23}{36}$ take $11\frac{7}{8}$.

8. A can do a piece of work in 15 days, B in 18 days, and C in 12 days. How many days will it take the three working together to do the work?

9. When it is 9 o'clock P.M. Wednesday, in Chicago, what time is it in Berlin?

10. A commission merchant sold 7500 bu. of wheat at 65¢ and charged $2\frac{1}{2}\%$ commission. How much money should he remit to his employer?

11. How many 2-ft. cubes can be cut from a block 8′ × 6′ × 4′, if no allowance is made for waste in cutting?

12. What is the ratio of 191 lb. 10 oz. to 27 lb. 6 oz.?

13. $28.50 was deducted from the list price of an article. If the discount was $37\frac{1}{2}\%$, what was the list price?

14. A farmer had a field 24 yd. long and 18 yd. wide, in which he planted potatoes. The rows ran lengthwise and were 2 ft. apart, and 2 ft. from the fence. The hills were 18 in. apart, and 18 in. from the fence. How many hills of potatoes were planted?

15. Add 215 units, 215 tenths, 215 hundredths, and 215 thousandths.

16. In the center of a circular field 30 rd. in diameter is a circular pond 10 rd. in diameter. How many square rods of the field are not covered by water?

17. What per cent of $2\frac{1}{2}$ A, is 40 sq. rd.?

1. \$4620 is 131% more than another number.

2. An article that cost \$20,000, was sold for \$19,700.

3. A and B can do a piece of work in 18 days. A can do it alone in 24 days.

4. A real estate agent sold two houses at \$3900 each. On one he made 20% and on the other he lost 25%.

5. The diameter of a cylinder is 16 in. and its length is 12 ft.

6. The difference between two numbers is 40, and the larger is 5 times the smaller.

7. A man had \$5000 in the bank. He drew out 20% of it, then 30% of the remainder. He afterwards deposited 15% of the sum he had drawn out.

8. A man loaned his friends \$900. At the end of 3 yr. 4 mo. 27 d., the friend returned it with interest at 5%.

9. A man insured his house for \$3500 at $1\frac{3}{4}\%$, and his furniture for \$3000 at $\frac{3}{4}\%$.

10. The base of a rhomboid measures 42 ft. and its altitude 16 ft.

11. A merchant imported from France 24 doz. pairs of gloves, invoiced at 6 francs a pair.

12. A wholesale dealer sold 3400 bbl. of flour at \$5.00 a barrel with a discount of 8% and $2\frac{1}{2}\%$.

13. A rectangular field is 215.11 ft. long, and its length is 7 times its width.

14. A man bought a horse, carriage, and harness for \$240. He gave three times as much for the carriage as for the harness and as much for the horse as he did for both the carriage and the harness.

15. A half mile of road was built at a cost of \$4.75 a rod.

16. In the center of a room, $23\frac{1}{2}$ ft. square, there is a rug 18 ft. square. The rest of the floor is covered with oilcloth, which extends 6 in. under the rug on all sides. The rug cost \$1.75, and the oilcloth 85¢ a square yard.

1. Suppose you each put \$200 in a savings bank Jan. 1, with the understanding that you are to receive 4% interest. How much interest will be due you the following January?

2. If you go to the bank and draw out \$8, you will still have in the bank how much money?

3. If you do not draw out the \$8, it will be added to the sum you first put in. How much money will you have on interest the second year?

4. What will be the interest of \$208 for the second year?

5. What will be done with the \$8.32, if it is not called for? How much will you have in the bank the third year?

6. How much more money have you in the bank at the end of the third year than you put in the bank at first?

Solution:

\$200.00 Principal.
8.00 Interest for 1st year.
\$208.00 Principal for 2d year.
8.32 Interest for 2d year.
\$216.32 Principal for 3d year.
8.65 Interest for 3d year.
\$224.97 Amount in bank.
200.00 1st Principal.
\$24.97 Interest for 3 years.

Find the amount of the first principal for the first period of time. Use this amount as a new principal and find the amount for the second period of time, and so continue. The last amount is called the compound amount. From the last amount subtract the first principal to find the compound interest.

7. When the interest as it becomes due is added to the principal, and the interest is reckoned on the amount, the owner is said to receive **compound interest.**

8. Interest is usually compounded annually, semi-annually, or quarterly. In this book compound annually, unless otherwise directed.

1. What is the compound interest on \$450 for 4 yr. 3 mo. 15 d. at 4%?

NOTE:—First find the amount for the whole periods, 4 yr. Then find the interest on this amount for the remaining time, 3 mo. 15 d.

2. What is the difference between the simple and compound interest on \$500 for 5 yr. 6 mo. 18 d. at 6%?

Find the compound interest on:

3. \$4500 for 2 yr. 6 mo. at $3\frac{1}{2}$%.
4. \$1278 for 3 yr. 9 mo. at 4%.
5. \$2576 for 4 yr. 2 mo. 12 d. at 5%.
6. \$728 for 2 yr. 9 mo. 24 d. at 3%.
7. \$6793 for 3 yr. 6 mo. 15 d. at 4%.
8. Find the compound interest on \$600 for 1 yr. 9 mo. at 4% annually, compounded semi-annually.

\$600	1st Principal.
12.00	Int. for 1st period.
\$612.00	2d principal.
12.24	Int. for 2d period.
\$624.24	3d principal.
12.484	Int. for 3d period.
\$636.724	4th principal.
6.367	Int. for 3 mo.
\$643.091	Compound amount.
600.00	1st principal.
\$43.09	Compound interest.

Since the rate is 4% compounded semi-annually, there will be 3 full periods of 6 mo. each, and the rate for each period will be 2%. This gives us \$636.724 as our amount. Find the simple interest on this sum for the remaining 3 mo. at 4%.

Find the compound interest on:

9. \$1678 for 2 yr. 5 mo. at 6%, compounded semi-annually.
10. \$550 for 1 yr. 4 mo. at 4%, compounded quarterly.
11. \$1248 for 4 yr. 6 mo. at 4%, compounded semi-annually.
12. \$4124 for 3 yr. 3 mo. at 6%, compounded quarterly.

Bankers always find both simple and compound interest by means of tables.

COMPOUND INTEREST TABLE

AMOUNT OF $1, AT VARIOUS RATES, COMPOUND INTEREST, 1 TO 20 YEARS

Years	1½%	2%	2½%	3%	4%	5%	6%
1	1.015000	1.020000	1.025000	1.030000	1.040000	1.050000	1.060000
2 ...	1.030225	1.040400	1.050625	1.060900	1.081600	1.102500	1.123600
3 ...	1.045678	1.061208	1.076891	1.092727	1.124864	1.157625	1.191016
4 ...	1.061364	1.082432	1.103813	1.125509	1.169859	1.215506	1.262477
5 ...	1.077284	1.104081	1.131408	1.159274	1.216653	1.276282	1.338226
6 ...	1.093443	1.126162	1.159693	1.194052	1.265319	1.340096	1.418519
7 ...	1.109845	1.148686	1.188686	1.229874	1.315932	1.407100	1.503630
8 ...	1.126493	1.171659	1.218403	1.266770	1.368569	1.477455	1.593848
9 ...	1.143390	1.195093	1.248863	1.304773	1.423312	1.551328	1.689479
10 ...	1.160541	1.218994	1.280085	1.343916	1.480244	1.628895	1.790848
11 ...	1.177949	1.243374	1.312087	1.384234	1.539454	1.710339	1.898299
12 ...	1.195618	1.268242	1.344889	1.425761	1.601032	1.795856	2.012197
13 ...	1.213552	1.293607	1.378511	1.468534	1.665074	1.885649	2.132928
14 ...	1.231756	1.319479	1.412974	1.512590	1.731676	1.979932	2.260904
15 ...	1.250232	1.345868	1.448298	1.557967	1.800944	2.078928	2.396558
16 ...	1.268986	1.372786	1.484506	1.604706	1.872981	2.182875	2.540352
17 ...	1.288020	1.400241	1.521618	1.652848	1.947901	2.292018	2.692773
18 ...	1.307341	1.428246	1.559659	1.702433	2.025817	2.406619	2.854339
19 ...	1.326951	1.456811	1.598650	1.753506	2.106849	2.526950	3.025600
20 ...	1.346855	1.485947	1.638616	1.806111	2.191123	2.653298	3.207136

1. Find the compound interest on $700 for 14 yr. 4 mo. at 4%.

From the table we find that the amount of $1 at 4% compound interest for 14 yr. is $1.731676. The amount of $700 for the same time and rate must be 700 times $1.731676 = $1212.173. Find the amount on this sum for 4 mo. at 4%.

2. Find the compound interest on $2200 for 15 yr. 6 mo. at 5%.

3. Find the compound interest on $480 for 9 yr. at 5%, compounded semi-annually. This is the same as for 18 yr. at 2½%.

4. Find the compound interest on $1850 for 5 yr. 6 mo. at 6%, compounded quarterly. This is the same as for 22 yr. at 1½%.

1. What dimensions of a triangle do you need to know to find its area?

2. How do you find the perimeter of a triangle?

3. What dimensions of a square or a rectangle must be known to find its area?

4. Given the perimeter of a square, how do you find its area?

5. Given the perimeter and length of a rectangle, how do you find its width? How do you find its area?

6. What is a parallelogram? What dimensions do you need to know to find its area?

7. Given the area and width of a parallelogram, what can be found? How can you find it?

8. Given the area of a triangle and its altitude, what can you find? How can you find it?

9. Given the diameter of a circle, how can you find its area?

10. Given the circumference of a circle, how can you find its area?

11. What 3 things do you need to know to find out the number of yards of carpet required for any room?

12. What 3 things do you need to know to find out how many square feet of plastering are needed for any room?

13. What dimensions of a rectangular solid do you need to know to find its volume?

14. Given the volume and two dimensions of a rectangular solid, how do you find the other dimensions?

15. Given the height and diameter of a cylinder, what can you find? How can you find it?

16. Given the volume and diameter of a cylinder, what can you find? How can you find it?

17. How would you estimate the number of bricks needed for a straight wall? Needed for a house?

1. Place a cube on your desk. How many dimensions has it? How many faces has it?

2. These faces are called its surfaces. A **surface** is a boundary of a solid. Define surface.

3. How many dimensions has each surface?

4. Surfaces are bounded by edges called lines. A **line** is the limit of a surface, or it is the path traced by a point as it moves from one position to another. To read a line we usually use two letters, naming the starting-point first.

5. How many dimensions has a line?

6. How are the lines of a cube limited?

7. A **point** is the limit of a line and has no extent, only position. Define point.

8. In the cube how many faces meet to form a line?

9. Each face is bounded by how many lines? If the cube has six faces, and each face has four lines, how many lines has the cube? Why is not the number 24?

10. How many lines meet at each point? If the cube has 12 lines, and each line has two points, how many points has the cube? Why not twenty-four?

11. In a square prism, how many surfaces, lines, and points are there?

12. By how many lines is each surface bounded? How many surfaces meet in each line? How many lines meet at each point? Are the surfaces the same shape and size?

13. Examine in the same way a triangular prism and an hexagonal prism.

14. What kind of lines have you found on these solids?

15. A **straight line** is a line which has the same direction throughout its entire length.

16. Define a straight line. Draw one.

17. Look at a cylinder. How many edges or lines has it? Are these lines straight? What are they?

1. Define a curved line. Write: A **curved line** is a line that constantly changes its direction.

2. Fasten a weight to one end of a cord. Hold the other end at rest on the hand. This is a **plumb line,** and is said to be vertical.

3. Define a vertical line. Draw one.

4. A **horizontal line** is a line which has the direction of any line in the surface of still water. Practically it is a line that points towards the horizon.

5. Lines neither vertical nor horizontal are called **inclined lines** or **oblique lines.**

6. How are horizontal lines represented on paper? Vertical lines?

7. Hold your ruler vertically, horizontally, inclined. Draw on paper lines to represent these three positions.

8. Draw a vertical line, and through it two horizontal lines.

9. Draw two lines which have the same direction, that is, do not meet, however far extended. These lines are said to be **parallel.** Define parallel lines.

10. Draw two parallel straight lines. Two parallel curved lines.

11. Draw two parallel horizontal lines. Two parallel vertical lines.

12. Draw two lines not parallel. Prolong them till they meet.

13. This point of meeting is called their **intersection.** Define intersection.

14. Hold two pencils parallel. Hold them so they will intersect.

15. Are two vertical lines always parallel to each other?

16. Can two horizontal lines ever intersect each other?

17. Give examples of vertical and horizontal lines.

1. Draw several parallel lines freehand. Test and correct them with ruler and triangle.

2. Write: When one line meets another line so as to make adjacent angles equal, the lines are said to be **perpendicular** to each other.

3. Draw two lines so as to form equal adjacent angles. Define perpendicular lines.

4. Draw a line perpendicular to a vertical line. Draw one perpendicular to an inclined line.

5. Draw three lines: (*a*) All parallel; (*b*) Two parallel, one perpendicular to them; (*c*) No two parallel, all intersecting at one point; (*d*) No two parallel, and not all meeting at a point.

6. In case (*d*), in how many points do the lines intersect?

7. Draw freehand a horizontal line of any length. Draw a vertical line of equal length. Test your work.

8. Draw two lines whose ratio shall be as 1 : 2; 1 : 4; 1 : 6.

9. Draw two lines whose ratio shall be as 2 : 3; 3 : 4; 2 : 6.

10. What is meant by drawing to a scale?

11. How long would you draw a line to represent 20 in., using a scale 1 : 8?

12. How many centers can a circle have? How many circles can have the same center?

13. Can a plane surface and a curved surface be parallel? Draw a straight line and a curved line that shall be parallel.

14. If I use a scale of $\frac{1}{4}$ in. to a foot, what ratio do I use?

15. What is the standard unit of length in this country?

16. Draw to a convenient scale lines representing 130 ft.; 250 yd.; 75 rd.

17. What scale did you use?

18. How many lines parallel to a given line can be drawn through a point outside of the line?

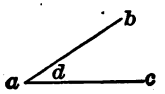
1. Take the dividers, and open the points one inch.

2. Do the legs of the dividers now point in the same direction or in different directions?

3. Draw lines to represent the legs of the dividers.

4. These lines are said to make an angle.

5. What is an angle? An **angle** is the difference in direction of two lines.



6. In this figure the lines *ab* and *ac* are called the sides of the angle. The point where these lines meet, as at *a*, is the **vertex.**

7. Define vertex.

8. The angle in 6 is named by reading the angle *d*, or the angle *cab*.

9. Draw two lines perpendicular to each other. The angle you have formed is called a right angle.

10. Define a right angle.

11. Draw two lines that shall meet but not be perpendicular to each other. The angle formed is an oblique angle.

12. Define an oblique angle.

13. Is the angle you have formed less than a right angle? If so, it is an acute angle.

14. Define an acute angle.

15. Is the angle you have formed greater than a right angle? If so, it is an obtuse angle.

16. Define an obtuse angle.

17. At 2 o'clock what angle do the hands of a watch make?

18. At 9 o'clock what angle do the hands make?

19. What kind of an angle does a vertical line make with a horizontal one?

20. Starting at 12 o'clock, in what time will the hands of a clock be at right angles to each other?

1. Draw several angles, and measure them by using a protractor. First estimate their size before measuring.

2. Using your protractor, make an angle of 45°; 60°; 90°; 30°; 150°; 135°; 100°; 40°; 20°.

3. Draw several angles, and by means of the protractor make other angles equal to each of them.

4. Draw an angle. Using protractor, make another angle twice the size of the given angle. Do the same, using dividers.

5. Draw an angle. Make another of $\frac{1}{2}$ the size; of four times the size.

6. Draw a horizontal line, AB. At a point C in the line, draw an oblique line that shall not cut AB. Measure the angles. Add their result. What is the sum?

7. Do the same after drawing one vertical and two oblique lines.

8. Draw three lines cutting each other at one point. How many angles are formed? Measure them. Add results. What is the sum? What ought it to be?

9. Draw a four-sided figure. Estimate the angles of the figure. Record your estimate in one column; the true value, found with a protractor, in another; and the error in a third column.

10. Substituting a five-sided figure, repeat 9.

11. Substituting a six-sided figure, repeat 9.

12. Using a protractor, erect a perpendicular at each extremity of a horizontal line; of an oblique line; of a vertical line.

13. Draw a vertical line. Using a protractor and ruler, construct a square upon this line.

14. How many degrees are passed over by the hour hand of a clock in an hour? In 3 hours?

15. In how many hours will the hour hand pass over 90°?

1. In 840 in. there are how many feet?

2. At 6¢ a yard, find the cost of a rope 720 in. in length.

3. At 36¢ a yard find the cost of three pieces of ribbon. In one piece there are 27 in., in another $\frac{1}{4}$ yd., and in the third, $1\frac{1}{2}$ yards.

4. If you have \$25, and spend \$17.25 for a suit of clothes, and \$3.25 for a pair of shoes, how much of your money will you have left?

5. If two pairs of gloves are worth $\$1\frac{1}{2}$, what are two dozen pairs worth? Do not find the cost of one pair.

6. At 40¢ a peck, what will a man receive for 96 qt. of beans?

7. Find the total cost of $4\frac{1}{2}$ lb. of beefsteak at 16¢ a pound, and 4 chickens at $\$1\frac{1}{4}$ each.

8. What will 4 boxes of butter cost at 25¢ a pound, if each box contains 25 pounds?

9. Find the cost of an ounce of tea, when $\frac{1}{2}$ lb. costs \$.32.

10. If a man's salary for 8 months is \$840, what will be his salary for 6 months? For 1 year?

11. Divide 250 by $\frac{2}{5}$ of 25.

12. To how many customers can you sell a quart of chestnuts, if you have 3 bu. in all?

13. The divisor is 9 and the quotient \$16. What is the dividend?

14. If you have \$3.50, how many yards of ribbon can you buy at 5¢ a yard and have 30¢ left?

15. Find the cost of $4\frac{1}{2}$ gal. of oil at 10¢ a gallon.

16. Find the cost of $1\frac{1}{2}$ lb. of candy, if $\frac{1}{4}$ lb. costs 15 cents.

17. What is $\frac{1}{7}$ of 574? $\frac{1}{6}$ of 744?

18. If 2 bu. of apples cost \$2.40, what will a peck cost?

19. How many 7's must be added together to make 224?

20. \$18 pays for how much insurance at $\frac{3}{4}\%$ premium?

1. In a school of 168 pupils twice as many study history as Latin, and twice as many study algebra as history. How many pupils are there in each class?

2. A father's age is 3 times that of his son, and their ages added together amount to 48 years. How old is the son?

3. Find the volume of a cylindrical smoke stack 4 ft. in diameter and 65 ft. in height.

4. A filter is 14 ft. in diameter and 10 ft. deep. On the bottom is a layer of sand and charcoal 4 ft. deep. How many gallons of water are there in the filter, if the water is within 2 ft. of the top?

5. A floor 26 ft. long contains 325 square feet. Find the width of the floor.

6. Find the cost of carpeting a room 32 ft. by 25 ft. with carpeting 27 in. wide at $\$1.37\frac{1}{2}$ a yard, if the breadths run lengthwise and 8 in. on a breadth is allowed for matching.

7. Find the cost of plastering at 36¢ a square yard the walls and ceilings of two rooms. One room is $15' \times 15' \times 8\frac{1}{2}'$, and the other room is $14\frac{1}{2}' \times 16' \times 8\frac{1}{2}'$. Deduct 20 sq. ft. for each of the 7 openings.

8. A commission merchant charged \$103.68 for selling 960 bbl. of potatoes at \$2.40 a barrel. Find his rate of commission.

9. The rate of insurance is 70¢ on \$100, what is the rate on \$1? If \$118.44 is the premium, what is the amount of insurance?

10. Using the table find the compound interest on \$3000 for 9 yr. 6 mo. 18 d. at 4%, compounded semi-annually.

11. What is the cash value of a bill of goods amounting to \$2250, at a discount of 20% and 5% for cash?

12. How much will a discount of 25% and 5% reduce a bill of \$2400?

1. A dealer sold 120 bbl. of flour for \$792, which was 12% less than he paid for it.

2. A merchant bought 6120 buttons at \$8.00 a great gross (144 doz.) and retailed them at 12¢ a dozen.

3. An irregular stone was thrown into a cylinder 40 in. in diameter, which was partly filled with water. After the stone was thrown in, the water in the cylinder rose 10 in.

4. Mr. Brooks raised 5 times as many bushels of potatoes as Mr. Avery, and Mr. Maxfield raised 10 bu. more than both of the others. All together they raised 322 bushels.

5. A house worth \$16,000 was insured for $\frac{7}{8}$ of its value at $1\frac{1}{2}\%$, and later was totally destroyed by fire.

6. Mr. A loaned \$620 for 4 yr. 3 mo. at 6% annually, interest payable quarterly.

7. Mr. B loaned the same sum at the same rate of interest, but the interest was payable annually.

8. The parallel sides of a field in the form of a trapezoid are 24 rd. and 68 rd., and the distance between them is 24 rd. The field was sold at \$80 an acre.

9. A merchant bought 360 yd. of cloth for \$630; $\frac{1}{4}$ of it was damaged by fire, but he sold the remainder so as to gain 20% on the whole.

10. The premium on 4800 yd. of silk was \$175. The insurance was on $\frac{5}{8}$ of the value of the silk at $3\frac{1}{2}\%$.

11. A drover sold 600 sheep at \$5 a head. He gained 50% on one half of them, and lost the same per cent on the other half.

12. A ship in 20° west longitude sent a wireless telegram at noon. It was received in London immediately.

13. A man left an estate of \$15,000 to be divided between his wife and daughter in the ratio of 2 to 3.

14. A grocer insured his goods for \$18,000, which was $\frac{6}{7}$ of their value. He paid a premium of \$225.

1. Mention several things for which a city or town needs money.

2. Money to pay for schools, roads, sewers, lights, fire and police protection, is raised by means of a tax.

3. A sum of money assessed on persons and owners of property to meet the expenses of a town, county, city, or state, is called **a tax.**

4. **Poll** means head. What, then, is a poll-tax?

5. Who pays a poll-tax? Does a man need to own property in order to be assessed a poll-tax?

6. Any tax upon real estate or personal property is called **property tax.**

7. **Real estate** is a form of property that consists of lands, houses, or, in general, immovable property.

8. **Personal property** consists of money, horses, merchandise, or, in general, movable property.

9. **Assessors** are persons appointed to make an inventory of all taxable property and estimate its value. The value the assessors put on property is called its **assessed value.** In some places property is not assessed for its full value.

10. The **collector** is the one chosen to collect the taxes.

11. Find out how large a poll-tax is assessed in your town or city, and also how large a tax on property is assessed.

12. Taxes are usually assessed as follows:

a. The state determines the amount to be expended for state purposes and divides that amount among the counties according to their valuation.

b. The county adds to this sum the amount it will need for county expenses and divides the total among the towns of the county according to their valuation.

c. Each town adds to this amount whatever it needs for its own local expenses and thus finds the total tax or tax levy.

1. In some states the county and state tax are found separately and are not united with the town tax.

2. The **rate of taxation** is usually expressed as a certain amount on each dollar, which can be easily changed to a rate per cent. Thus a tax of 15 mills on a dollar is $1\frac{1}{2}\%$.

3. Taxes are usually collected as follows:

a. The assessors find the number who must pay a poll-tax. Then multiply the tax on one poll by the number of polls to find the *poll-tax.* The poll-tax is then subtracted from the *tax levy.* The remainder is the *property tax.*

b. The assessors next find the entire valuation of the town, which is called the *total valuation.*

c. They next divide the property tax by the total valuation to find the tax on \$1, called the *tax rate.*

d. They now multiply the value of each man's property by the tax rate and find his tax on property.

4. There are 4120 persons, each of whom pays \$1.50 in the city of B. The total valuation is \$5,864,528, and the total tax \$94,147.92. What property tax must Mr. Philips pay who owns a mill valued at \$4500 and who owns personal property at \$1240?

$\$1\frac{1}{2} \times 4120 = \$6180.$
$\$94{,}147.92 - \$6180 = \$87{,}967.92.$
$\$87{,}967.92 \div \$5{,}864{,}528 = .015.$
$\$4500 + \$1240 = \$5740.$
$\$5740 \times .015 = \$86.10$

Study each step as given in example 3, and compare with each step of this solution.

5. The property valuation of a town is \$1,500,000, and the tax levy is \$12,500. There are 250 men, each paying \$2. Mr. Dunbar's real estate is valued at \$7500 and his personal property at \$4500. Find his tax, including a poll-tax.

6. In the town of C there are 2500 polls, each taxed \$2. The tax levy is \$245,000, and the taxable property is \$12,000,000. Find Mr. J's tax on property worth \$125,000.

1. Given the amount of taxable property and the tax to be raised, what can you find? How can you find it?

2. The amount of taxable property is \$200,000,000. If the tax levy is \$2,000,000, what is the tax rate?

3. Given the amount of taxable property and the rate of taxation, what can you find? How can you find it?

4. Mr. S is worth \$50,000. If the rate of taxation is $1\frac{1}{2}\%$, what tax must Mr. S. pay?

5. Given the tax to be raised, and the rate of taxation, what can you find? How can you find it?

6. Mr. M's tax last year was \$45. If the rate of taxation was 15 mills on \$1, find the assessed valuation of his property.

7. The rate of taxation in the town of C is $1\frac{1}{2}\%$. What is the tax of Mr. A, whose real estate is valued at \$3000 and personal property at \$1000?

8. When the rate of taxation is $1\frac{3}{5}\%$, what tax must Mr. Smith pay, if he is worth \$5000?

9. Find the tax on property assessed at \$2000, when the rate of taxation is 12 mills on a dollar.

10. Mr. A paid \$6 as a special tax levied at 6 mills on \$1. Find the value of his property.

11. The tax rate is 13 mills. How much tax must be paid on property assessed at \$12,000?

12. In a certain town there are 1200 polls, each assessed \$2. Find the poll-tax. If the tax levy is \$40,000, how large a tax must be raised on property?

13. In the town of B, the assessed valuation of the property is \$200,000, and the tax levy is \$4000. What is the rate of taxation?

14. If the tax rate is $1\frac{1}{2}\%$ and your father's property is assessed at \$4000, what tax must he pay, including a poll-tax of \$2?

1. A tax of \$50,000 is levied in a town valued at \$3,200,000. There are 1000 persons who pay a poll-tax of \$2. What is C's tax if his property is valued at \$9000 and he pays a poll-tax?

2. The real estate of a city is assessed at \$3,099,500, and the personal property at \$1,487,280. The tax levy is \$66,023.92, and there are 1340 polls assessed at \$1.35. Find Mr. A's poll and property tax, if his property is assessed at \$18,000.

3. When the tax rate is 21 mills on a dollar, what is the assessed value of property that pays a tax of \$626.22?

4. What is the rate of taxation when \$2,285.10 is the tax upon \$152,340?

5. There are 200 taxable polls in the town of Sheffield, each assessed \$2. The expenses of the town are \$16,150, and the valuation of the property is \$1,750,000. Mr. Mellen owns \$2460 worth of property. Find his tax including one poll.

6. A man's property is assessed at \$6500 and the rate is 3 mills on a dollar. Find the amount of his tax if he is allowed 2% for payment before a certain date.

7. In the town of H there are 1200 polls, each taxed \$1. The taxable property is \$30,000,000 and the tax levy is \$151,200. What tax does Mr. Sims pay who is assessed \$12,000 for real estate and \$2500 for personal property and who pays one poll-tax?

8. How much tax will a person pay whose property is assessed at \$246,500, if he pays $1\frac{3}{4}\%$ city tax, 1% school tax, and $\frac{3}{4}\%$ county tax?

9. The real estate of a town is assessed at \$1,105,843, and the personal property at \$249,031. The tax to be raised is \$21,258.11, and there are 850 polls, each assessed \$1.10. What tax will Mr. Martin pay if his property in the town is assessed at \$8650 and he, not being a resident of the town, pays no poll-tax?

1. The product of a and b is written ab. The product of 5, x, and y is written $5xy$.

2. Write the product of 8 and c. Of 4, a, and d. Of 7, x, y, and z.

3. The product of a and a is not usually written aa, but a^2, and is read a squared or the square of a.

4. When $a = 4$, and $b = 2$, find the value of $3ab$.
This means $3 \times 4 \times 2 = 24$.
When $a = 4$, $b = 3$, $c = 1$, $x = 2$, $y = 5$, $z = 6$, find the value of:

5. $4a$	6. $3c$	7. $2y^2$	8. a^3	9. $2b^3$	10. $5x^4$
11. $7z$	12. c^2	13. $2z^2$	14. x^3	15. $4by$	16. $7x$
17. $2ab$	18. $3bc$	19. $4cx$	20. $5xy$	21. $6yz$	22. $2ax$

23. Express 4 increased by 5; a increased by b.

24. Express 9 diminished by 5; a diminished by b.

25. How much does b lack of being 15?

26. If a man walks 3 miles an hour, how many miles will he walk in x hours?

27. If a man walks x miles an hour, how many miles will he walk in c hours?

28. If one part of 12 is 7, what is the other part?

29. If one part of 15 is x, what is the other part?

30. If a pear costs $2x$ cents and a peach $3x$ cents, what will represent the cost of both?

31. If $3x = 9$, what does $3x + 5$ equal?

32. If $x - 4 = 8$, what does x equal?

33. If $x = 2$, what will $3x$ equal?

34. If $x = 7$, what will $x - 3$ equal?

35. If $x + 4 = 6$, what does x equal?

36. If $\frac{1}{5}x = 20$, what does $4x$ equal? What does x equal?

37. Let c represent the circumference of a cylinder and a its altitude. Find its convex surface.

1. The greater of 2 numbers is twice the less, and the sum of the numbers is 135. What are the numbers?

2. The sum of the ages of a mother and daughter is 36 years, and the age of the mother is 8 times that of the daughter. What is the age of each?

3. Divide 36 into three parts so that the first part shall be 3 times the second, and the second 2 times the third.

4. John is 2 times as old as Henry and the sum of their ages is 18 years. What is the age of each?

5. Alice had a certain sum of money, and earned twice as much. After spending 9 cents, she had 21 cents left. How much money did she earn?

6. The sum of two numbers is 155, and the greater is 4 times the less. What are the numbers?

7. The difference between 2 numbers is 132, and the greater is 4 times the less. What are the numbers?

8. One number is 4 times another, and their difference is 30. Find the numbers.

9. A man sold 3 houses of equal value and a barn for $24,000. If the barn brought $1600 less than a house, what was the price of each?

10. The sum of two numbers is 58, and the greater is 7 less than 4 times the smaller. What are the numbers?

11. Divide the number 133 into two parts such that one part is 15 more than the other part.

12. If 38 is added to 3 times a number, the sum will be 98. What is the number?

13. A farmer bought a horse, a cow, and a calf for $200. The cow cost six times as much as the calf, and the horse three times as much as the cow. What was the cost of each?

14. Samuel has a certain number of marbles, and John has 15 more than Samuel. If together they have 103 marbles, how many has each?

When $a = 4$, $b = 1$, $c = 3$, $x = 5$, $y = 7$, $z = 0$, find the value of:

1. $3x + 5z$	2. $3y - 4z$	3. $3a - 5b$	4. $5b + c$
5. $5c + 3a$	6. $4x - 2y$	7. $2y - 3b$	8. $2x + 5a$
9. $3y - 5a$	10. $x^2 - 3a$	11. $b^3 + a^2$	12. $xz - 2b$

13. If the length of a rectangle is x in. and the width y in., what is the perimeter of the rectangle? What is the difference between the length and breadth?

14. Express the area of this same rectangle.

15. Express the square of x; the cube of y; the fourth power of a.

16. x and y represent two numbers of which x is the greater. What will represent their sum? Their difference? Their product? Their quotient?

17. A triangle has a base a feet long and an altitude $2b$ feet long. What is its area?

18. The diameter of a circle is $2a$ feet and its circumference $2b$ feet. What is its area?

19. A boy had a kite-string x feet long. From it he cut 3 pieces, each y feet long. How many feet did he have left?

20. Write as an equation the statement: The excess of 17 over 8 is 9.

21. Write as an equation the statement: The excess of x over y is z.

22. $3x + 2 = 5$. What does x equal?

Indicate by use of exponents:

23. The fifth power of b.

24. The cube of x plus the square of y.

25. The number of quarts in 4 gallons.

26. The number of inches in 12 feet.

27. The number of seconds in a degree.

1. Three men together have \$68,400. If the second has \$3000 more than the first and the third \$2400 more than the second, how much has each?

2. What number must be added 3 times to itself that the sum may be 40?

3. George has 7 marbles more than William and they both have 29 marbles. How many has each?

4. Three men have \$63. A has \$3 more than C, and C has twice as many dollars as B. How many dollars has each?

5. A number and one third of the same number added together are 32. What is the number?

6. The difference between the ages of a father and his son is 24 years, and the father's age is three times that of the son. What is the age of each?

7. A farmer has 3 flocks of sheep, numbering in all 320 sheep. The flocks are in relative size as the numbers 1, 2, and 5. How many sheep are there in each flock?

8. A, B, and C entered into partnership, and their profits were \$1,612.50. If their capital invested is proportional to 16, 9, and 5, how should the gain be divided?

9. Three contractors agreed to dig a canal for \$1010. A furnished 60 men, B 200 men, and C 144 men. Of the sum received, how much should A, B, and C each receive?

10. Divide \$950 among three persons, giving the first \$3 as often as you give the second \$9, and the third \$13.

11. Divide \$1071 among A, B, and C, so that their shares shall be in the ratio of 5, 7, and 9.

12. Three men buy a mill for \$105,750. The sums they pay are to each other as 3, 5, and 7. What sum does each pay?

13. A horse and carriage are valued at \$420. If $1\frac{1}{3}$ times the value of the horse is equal to the value of the carriage, find the value of each.

1. If 3 horses cost \$200, how many horses can be bought for \$1600?

2. $3\frac{1}{3}$ is what part of 10? $2\frac{1}{2}$ is what part of 10?

3. What is the ratio of 14 to $3\frac{1}{2}$?

4. If $3\frac{1}{2}$ yd. of cloth cost \$9, what will 14 yd. cost?

5. What is the ratio of 20 to $6\frac{2}{3}$?

6. If $6\frac{2}{3}$ yd. of ribbon cost 60¢, what will 20 yd. cost?

7. What is the ratio of 9 to 36?

8. If 36 lb. of sugar cost \$2.16, what will 9 lb. cost?

9. What is the ratio of \$2.80 to 35 cents?

10. If 8 qt. of peanuts cost \$.35, how many quarts can be bought for \$2.80?

11. $6 : 12 = 15 : x$. Find the missing term.

12. If 9 yd. of cloth cost \$25, what will 18 yd. cost?

13. If the antecedent of a ratio is 8, and the ratio is $\frac{1}{3}$, what is the consequent?

14. When it is 4 P.M. in New Haven, by standard time, what time is it in Chicago? In San Francisco?

15. When it is 10 A.M. in New York, it is 1 P.M. at another place. What is the difference in longitude? In which direction from New York is the second place?

16. Divide 90 into two such parts that one part shall be 4 times the other part.

17. What is the interest on \$240 for 3 mo. at 5%?

18. What is the interest on \$400 for 15 d. at $4\frac{1}{2}$%?

19. What is the premium on a policy of \$2400 for 3 yr. at $\frac{1}{2}$% a year?

20. A man's property is assessed at \$20,000. If the rate is 15 mills on a dollar, what tax must he pay?

21. The list price of a bill of goods is \$1000, with discounts of 20% and 5%. Find the net price of the goods.

22. If the discount in example 21 had been 25%, what would have been the difference in the net price?

1. A room measures 18′ × 12′ × 10′. At 37¢ a square yard find the cost of plastering it, allowing 80 sq. ft. for doors and windows. At \$1.12½ a yard, find the cost of carpet, 27 in. wide, laid lengthwise, allowing 8 in. loss on each breadth for matching.

2. Find the cost of 10 girders, each 40 ft. long, 14 in. wide, and 12 in. thick, at \$28 per thousand feet.

3. Find the interest on \$3020 from Apr. 14, 1910, to June 10, 1913, at 5%.

4. Find the compound amount of \$2000 for 4 yr. 6 mo. at 4%.

5. A merchant marked goods at 20% above cost and sold them at 12½% below the marked price. What per cent did he gain? How much did he gain on goods that cost \$1200?

6. A man sold a span of horses for \$660 and gained 10% by so doing. Find the cost. What would have been the loss per cent, if the horses had been sold for \$570?

7. What is the rate of taxation when \$147,960 is raised on real estate valued at \$9,864,000?

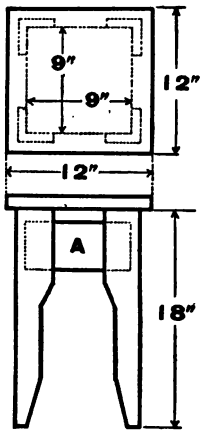
8. In an election A received a certain number of votes. B received 35 more than twice as many, and C 75 less than 3 times as many. The total vote was 14,050. How many votes did each receive?

9. Mr. Jones has a city lot measuring 66 ft. by 132 ft. What is it worth at \$2000 an acre?

10. A house valued at \$7200, and insured for ¾ of its value at \$12.50 on a \$1000, was destroyed by fire. What was the owner's loss?

11. A can do a piece of work in 6 days, B in 8 days, and C in 10 days. How much of the work can they do in 2 days working together?

12. What is the circumference of a carriage wheel that makes 37½ revolutions in going 336 ft.



1. The list of the number and sizes of pieces required in making an article is called the bill of lumber.

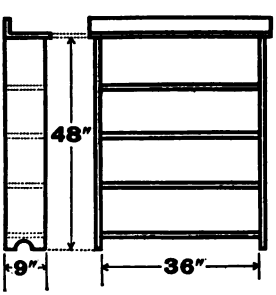
2. The legs of this tabouret are made of two pieces $\frac{1}{2}'' \times 3''$ nailed together. "A" is the rim made of $\frac{1}{2}'' \times 4''$ pieces fastened within the legs. Notice that there is a sub-top. Find all the other measurements from the drawing.

3. Make out a bill of lumber for this tabouret.

4. Find the cost at 10¢ a board foot of the lumber used in making 21 of these tabourets.

5. What would be the additional cost if the top were 15″ square and the sub-top 12″ square, and the rim correspondingly larger?

6. The top of this bookcase is 9″ wide and projects over each side $2\frac{1}{8}''$. The upright strip at the back of the top is made of a piece $\frac{7}{8}'' \times 3''$ of the same length as the top board. Find out the amount of lumber needed for the top and the 4 shelves, each 8 in. wide.



7. The back is made of $\frac{1}{2}''$ matched boards. Find the lumber for the back, adding $\frac{1}{6}$ to the amount because of the loss in matching.

8. Find the lumber needed for the two sides.

9. Make out a bill of lumber for the entire bookcase.

10. At 12¢ a board foot, find the cost of the lumber for 20 cases.

1. A manual training room in a certain school measures $40' \times 30'$. There are 21 benches, each $4' \times 2'$. What per cent of the room is occupied by the benches?

2. Across one end of the room is a case 8′ high and 3′ deep, divided into 8 compartments. Find the number of cubic feet of space taken up by the case. How many cubic feet are there in each compartment?

3. What per cent of the floor space is covered by the case?

4. On one side of the room are 4 demonstration settees, each occupying about 18 sq. ft. of space. What per cent of the floor space is covered by the demonstration settees?

5. What per cent of the floor space is covered by the benches, case, and settees?

6. The cost of each of the 21 benches was \$9.35, and the cost of the tools for the entire equipment was 80% of the cost of the benches. Find the entire cost.

7. Each bench has the same number and kind of tools, costing \$5.65 a set. How much was invested in extra tools for general use?

8. If the 280 boys, who are under instruction, use \$392 worth of lumber during the year, what is the average cost for each boy for a lesson, if the classes meet 35 times during the year?

9. Besides the lumber there is an extra expense for sandpaper, nails, screws, and sharpening tools. Sandpaper costs 1¢ a sheet, and each sheet is divided into 8 pieces. If each boy uses 2 pieces for each lesson, find the cost of sandpaper for the year.

10. If the cost of screws and nails is \$24.50 for the year, how much is the average cost for each boy for a lesson increased by the cost of the sandpaper, screws, and nails?

1. A national bank, also called a commercial bank and a bank of deposit, is an institution chartered by the national government, that is, given permission to do business.

2. The business that banks can do is:

a. To furnish a safe place of deposit for money.
b. To exchange money.
c. To issue notes for circulation.
d. To lend money on notes or any safe security.
e. To collect money on notes and drafts.

3. When a person opens an account at a bank he is given a check book. By using these checks he can draw out money himself or pay any bill he may owe by making the check payable to the creditor.

4. When a person wishes to draw money for himself he usually writes the check payable to Self, or Bearer, or Cash. It is better to use the word Self.

STUB

No. 236
Jan. 1 1910
To C. R. Hooker
For Mdse
Bal. Brot. Ford. 236 50
Amt. Dep.
Total, 236 50
Amt. This Check 100 00
Balance 136 50

CHECK

New Haven, Conn., Jan 1 1910
THE NATIONAL TRADESMEN'S BANK
Pay to the order of C. R. Hooker $100.
One Hundred Dollars.
No. 236 R. J. Bartlett

5. Suppose that Mr. R. J. Bartlett is owing $100 to C. R. Hooker of New York. Instead of sending the money he fills out a check like the above. If Mr. Hooker indorses (writes his name on the back) this check and presents it at any bank where he is known he will receive the money.

6. All banks have dealings with one another and the check will come back to the National Tradesmen's Bank, and the amount placed against Mr. Bartlett.

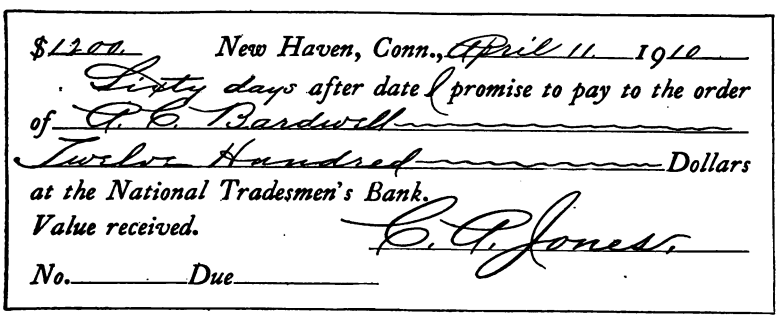
1. When this check is canceled it will be returned to Mr. Bartlett and can be kept by him as a receipt from C. R. Hooker, since he has indorsed it.

2. Make out a check for $37.50, payable to the order of C. B. Holmes. Indorse the check to the order of R. C. Brooks. This means that instead of simply writing his own name Mr. Holmes writes, "Pay to the order of R. C. Brooks," and signs his name beneath.

3. Make out a check for $14.20 payable to the order of S. H. Ives. Indorse the check to the order of A. B. Coe.

4. Besides helping in exchanging money by means of checks you have learned that banks help business by lending money on notes.

5. Suppose Mr. A. C. Bardwell sold C. A. Jones an automobile for $1200 and instead of money received a promissory note like the following:


$1200 New Haven, Conn., April 11 1910

Sixty days after date I promise to pay to the order of A. C. Bardwell

Twelve Hundred Dollars

at the National Tradesmen's Bank.

Value received. C. A. Jones

No. Due

If Mr. Bardwell wishes to receive money for this note at once he must:

a. Indorse it and thus become responsible for its payment, if Mr. Jones should fail to pay it when due.

b. Present the note at the bank, and if the officials are satisfied that both Mr. Bardwell and Mr. Jones are reliable, they will accept the note and advance some money.

1. How much will Mr. Bardwell receive if he presents the note at the bank Apr. 20?

a. The officials will first find when the note is due. This is found by adding the time specified in the note to the date. This is called the date of maturity. Thus Apr. 10 + 60 d. = June 9.

NOTE: — When the time of a note is expressed in months, calendar months are used in finding the date of maturity. When the time is expressed in days, the exact number of days is used. Formerly *three days of grace* were allowed, but since they have been abolished in most states they will not be considered in this book. They should be included in states that still allow them. In that case this note would be due June 12.

b. The bank will next find the exact number of days from Apr. 20 to June 9, which is 50 days.

c. They will next find the simple interest on $1200 for 50 days, which is $10.00.

d. Keeping this $10 as their discount they will give Mr. Bardwell $1200 − $10 = $1190.

2. **Bank discount** is the interest retained by a bank for advancing money on notes before they become due.

3. The **proceeds** is the amount received by the borrower and is equal to the *face* of the note less the discount.

4. The *number of days* from the date when the note is discounted to the date of maturity is called the **term of discount.**

NOTE: — In some states the term of discount would include both April 10 and June 9, making the term of discount 51 days. You should conform to the custom of your locality.

5. If this note is not paid by Mr. Jones on or before June 9, the note is said *to be protested,* and a notary public notifies Mr. Bardwell within 24 hours.

6. Why should a business man be careful not to allow his note to be protested?

7 What is the date of maturity of a note? How is it found?

8. What is meant by term of discount?

1. A 60 day note for \$846, without interest, dated Feb. 8, was discounted Feb. 23, at 6%. Find the proceeds.

Feb. 8 + 60 d. = Apr. 9. Date of Maturity.

a. Feb. 20 d.
Mar. 31 d.
Apr. 9 d.
60 d.

b. Feb. 5 d.
Mar. 31 d.
Apr. 9 d.
45 d.

c. \$6.35. = interest on \$846 for 45 days.

d. \$846 − \$6.35 = \$839.65 the proceeds.

a. This shows the method of finding the date of maturity when the time is in days. There are 20 d. in February after the 8th. There are 31 d. in March. It will take 9 days in April to complete the 60 days.

b. This shows the method of finding the term of discount. There are 5 d. in February after the 23d. There are 31 d. in March. There are 9 d. in April to the date of maturity. The sum is 45 d., the term of discount.

c. Find the simple interest on the face for 45 d. This is \$6.35, called bank discount.

d. Subtract the discount from the face. The remainder is \$839.65, the proceeds.

NOTE: — If this had been a 2 mo. note, we should have found the date of maturity like this: Feb. 8 + 2 mo. = Apr. 8.

Find the bank discount and the proceeds of the following non-interest bearing notes:

	Face	Date	Time	Date of Discount	Rate of Discount
2.	\$ 500	Sept. 10	60 d.	Sept. 30	6%
3.	\$ 450	Nov. 13	90 d.	Dec. 10	5%
4.	\$1000	Aug. 11	45 d.	Aug.17	4%
5.	\$1200	Jan. 5	75 d.	Feb. 6	6%
6.	\$ 875	July 7	60 d.	July 14	5%
7.	\$ 250.50	Nov. 21	2 mo.	Nov. 21	6%
8.	\$ 810.25	Oct. 2	3 mo.	Nov. 1	5%
9.	\$ 650.00	Feb. 21	4 mo.	March 11	6%
10.	\$ 550.00	May 20	3 mo.	June 30	6%
11.	\$1150.75	July 15	90 d.	Aug. 1	6%
12.	\$ 636.50	Dec. 24	60 d.	Jan. 2	5%

1. A promissory note is a written promise made by one person to pay another a definite sum of money on demand or at a definite time.

2. Study the two forms of notes on pages 30 and 115, till you can write either form from memory.

3. In each of these notes name:

a. The face, the sum of money specified.

b. The place and date when written.

c. The maker, the person who promises to pay.

d. The payee, the person to whom the money is to be paid.

e. The time and place of payment, if mentioned.

f. The rate of interest if an interest bearing note.

g. The indorser, the person who writes his name on the back.

4. When a person makes a payment in part or in full of any bill or account he should receive a receipt. A receipt is a written statement of the receipt of money or other property, and should give the date, the place, the persons interested, and sometimes for what the money was given.

5. The following is a usual blank form to fill out when full payment is made. When only part payment is made the words, "to apply on account" are written in place of "in full of all demands to date."

RECEIPT IN FULL.

$\$$_____ *Boston,*_____ *19*__

*Received of*_____

_____ *Dollars,*

in full of all demands to date

_____

1. A man took a 3 mo. note for \$220 in payment for a horse. He immediately discounted the note at a bank at 6%, and found that he had lost $33\frac{1}{3}\%$ of what the horse originally cost him. Find the cost.

2. A father placed \$100 in a savings bank in his boy's name, when the boy was 10 yr. old. Every half-year the bank added 2% to the deposit for interest, and the father added \$100 every year. What will be the amount on deposit when the boy is 15 years old?

3. If the rate of discount at a bank is 6%, what will be the proceeds of a 3-mo. note of \$570, dated May 23, and discounted June 14?

4. The face of a note is \$2160, the date July 12, the time 3 mo., the date of discount Sept. 9. Find the proceeds.

5. A man borrowed money at 6% and bought 1876 bu. of wheat at 75¢ a bushel, Sept. 5, 1910. On June 15, 1911, he sold all the wheat at $87\frac{1}{2}$¢ a bushel. After paying back the money he had borrowed, how much had he left as his gain?

6. On Sept. 14, 1910, James Murray wrote a check on the Merchants Bank in favor of Chas. S. Holmes for \$150. Write the check.

7. The following day Mr. Holmes sent Mr. Murray a receipt on account. Write the receipt.

8. Mr. C. J. Morse owned 60 acres of woodland. Nov. 15 he sold $\frac{1}{3}$ of the land to R. S. Miller at \$75 an acre and took a 3-mo. note in payment. Write the note.

9. Mr. Morse had the note discounted Dec. 1, at 6%. How much did he receive for the land?

10. State in order the three steps to be taken in finding the bank discount on any note.

11. If a man places \$600 in the savings bank, when the rate of interest is 4% per annum, payable semi-annually, how much can he withdraw at the end of 1 yr. 6 mo.?

1. What is the square of 5? $7^2 =$ ——. $8^2 =$ ——.
2. $30^2 =$ ——. $50^2 =$ ——. $60^2 =$ ——.
3. If 40 bu. of corn cost \$12, what will 400 bu. cost?
4. $9 : x = 12 : 4$. Find the value of x.
5. $2 : 8 = 4 : 16$. Read these ratios as fractions.

Change these ratios to fractional forms in their lowest terms:

6. 3 : 15	7. 6 : 12	8. 4 : 16	9. 2 : 10
10. 7 : 3	11. 12 : 5	12. 9 : 2	13. 13 : 4
14. 9 : 3	15. 15 : 3	16. 20 : 5	17. 21 : 7

18. 6 in. is what part of 2 ft.? What is the ratio of 2 ft. to 6 in.?

19. Find the bank discount on a note of \$1200, when the term of discount is 60 days and the rate 6%.

20. A note of \$1000 was discounted for 3 mo. at 6%. Find the proceeds.

21. A 3-mo. note was dated March 10. Find the date of maturity.

22. Who is the payee, in every note or check?

23. The amount of taxable property is \$40,000, and the rate of taxation is 20%. What can you find in this example? Find it.

24. Apple trees are listed in the catalogue at \$1. A farmer bought 100 for \$75. What per cent of discount from the list price did he receive on each tree?

25. The list price of the manufacturer of chairs was \$24 a dozen. A retailer sold them at \$3 each and gained 100%. What rate of discount did he receive from the list price?

26. Ingrain carpet is 1 yd. and Brussels carpet is 27 in. wide. How many yards of each kind of carpet will be needed for a room 9 ft. by 18 ft., if the breadths run lengthwise?

27. What numbers between 24 and 84 are perfect squares?

1. A certain number and $\frac{2}{3}$ of the number equals 15. What is the number?

2. A 60 days' note for \$429 was dated Feb. 21, and discounted Mar. 11, at 5%. Find the proceeds.

3. If a man places \$600 in a savings bank when the rate of interest is 4% per annum, how much can he withdraw at the end of 1 yr. 6 mo., if interest has been compounded semi-annually?

4. How deep must a bin 12 ft. square be made to hold 864 bushels of potatoes?

5. When it is 6.30 A.M. at A, longitude 20° 15′ 20″ E, what time is it at B, 15° 10′ 20″ W?

6. At \$1.87$\frac{1}{2}$ a yard, what will it cost to carpet a room 18 ft. long, 15 ft. wide, with carpet 27 in. wide, if the breadths run lengthwise?

7. A furniture dealer had 800 chairs which cost him \$6 each. A fire destroyed 30% of them, and he sold the remainder at \$8.50 each. How much did he lose?

8. At 2$\frac{1}{2}$% premium a man paid \$177.50 for insurance on his property. What was the value of the property?

9. An agent sold 75 bales of cotton, each bale weighing 350 lb., at 12$\frac{1}{2}$¢ a pound, on a commission of 2$\frac{3}{4}$%. What was his commission? What sum must he return to his employer as net proceeds?

10. Two of the boundary lines of a field run north and south and are 60 rd. and 48 rd. in length. If the distance between these lines is 36 rd., how many acres are there in the field?

11. How many bricks should you estimate by mason's measurement for the 12 in. walls of a house 40 ft. long, 28 ft. wide, and 22 ft. high, if 56 cu. ft. are deducted for openings?

12. At \$6.50 a cord, a pile of 4-ft. wood, 32 ft. long, cost \$35$\frac{3}{4}$. How high was the pile?

1. What dimensions of a square prism do you need to know to find its volume?

2. When you know the volume and one side of the square base, how do you find the altitude of a square prism?

3. One man has loaned a certain sum of money at simple interest at 4%. Another man has placed the same sum of money in the savings bank at 4%. At the end of the 4 years which man will receive the larger amount of interest? Why?

4. State the steps necessary to take in finding the proceeds of a non-interest bearing promissory note.

5. How do you find the square of a number? How do you find the cube of a number?

6. If you know the side of a square, how do you find its area?

7. If you know the side of a cube, how do you find its volume?

8. State two ways of finding out whether four numbers are in proportion.

9. If you know all the terms of a proportion except the last, how can you find that?

10. If you know all the terms of a proportion except the antecedent of the first ratio, how can you find that?

11. State the two ways you have learned for finding the difference in dates. Which method is usually used in examples of interest? Why?

12. Give the name of the third place to the right of the decimal point. Give the last three letters of the word.

13. Give the term in fractions that tells into how many parts the unit has been divided.

14. Give the name of a number that does not refer to any particular thing.

15. If you know the difference in longitude between two places, how do you find the difference in time?

In a school lunch room the following orders for food were prepared:

No. of Orders	Food	Cost	Selling Price	Gain
68	Tomato Soup	$2.00	5¢ per order	
68	Hamburg Steak	2.17	7¢ "	
45	Baked Beans	1.89	6¢ "	
60	Brown Bread	.50	4¢ "	
25	Cocoa	.45	5¢ "	
60	Cottage Pudding	2.89	8¢ "	
90	Salmon Salad	1.35	5¢ "	
48	Gingerbread	1.37	5¢ "	

1. Find the total gain.

2. Find to the nearest hundredth the gain per cent.

3. The school authorities decided that the gain was too great and reduced the price of each order 1 cent. Find the gain on the same number of orders after the reduction was made.

4. Find to the nearest hundredth the gain per cent.

5. On the following day another reduction of 1 cent an order was made. Find the total gain then and the gain per cent.

From your geographies find:

6. The length of North America in degrees.

7. The width in degrees of the United States at its widest part.

8. The number of degrees in length and width of Africa.

9. Ship A is at longitude 5° 30′ 20″ west, and ship B. is at longitude 2° 15′ 10″ east. What is the difference of their longitudes? What is their difference in time?

10. What is the relative position in reference to each other? Which ship has the earlier time?

11. The tax levy in a city is $1,987,275, and the rate is 15 mills on the dollar. What is the assessed valuation?

1. A man traveled 320 miles in three days. If he traveled 3 times as far the first day as he did the third and 4 times as far the second day as the third, how far did he go each day?

2. A bin is 11 ft. 6 in. long, 4 ft. wide, and 6 ft. deep. How many bushels of wheat will it hold? How many of apples?

3. What tax must a man pay if his property is valued at \$5600 in a town where a tax of \$3240 is to be raised? There are 398 polls, each paying \$1.50, and the taxable property is valued at \$440,500.

4. Find the difference between the simple and compound interest of \$660 for 3 yr. 4 mo. 24 d. at 6%.

5. How many board feet are there in 100 boards, each 9 ft. long and 8 in. wide?

6. An employer received from his agent \$1185 as the net proceeds of a sale of \$1250. Find the rate of the agent's commission.

7. Which is better for the purchaser, and how much, a discount of 20% and 10%, or a discount of 30% from a bill of \$3650?

8. A man bought 120 bbl. of apples and sold them for \$345, thereby gaining 15%. What did the apples cost a barrel? If the apples had been sold for \$275, what would have been the loss per cent?

9. Add: 13, 33, 98, 84, 62, 38, 85, 76, 47, 61, 87, 27, 75, 53, 35, 28, 32, 26, 96, 68, 77, 66, 83, 74, 78, 91, 73, 89, 46, 46.

10. If $\frac{1}{7}$ of a number exceeds $\frac{1}{8}$ of it by 224, what is the number?

11. From $\frac{1}{2}$ of a tenth take $\frac{1}{5}$ of a thousandth.

12. A man's crop of wheat brought him \$1687.50, the selling price being 75¢ a bushel. The field in which the wheat grew contained 45 acres. Find the average yield an acre.

Review Lessons 1 to 6

1. What is addition? What is the result of addition called?

2. Add: 732, 3296, 69923, 2379, 3291, 923, 72, 264, 2842, 8248, 723, 902, 7009, 82, 6284, 49, 9936, 783, 827, 7849.

3. What is subtraction? What are the terms of subtraction called?

4. From 10,201,603 take 7,186,476.

5. Find the balance when the receipts for a week are as follows: \$760.25, \$415.13, \$169.36, \$408.32, \$109.21, \$166.67, and the expenses, \$75.50, \$360, \$33.15, \$75.75, \$128.50.

6. What is notation? What system of notation do we use?

7. Write a number that contains 5 periods of integers, and 5 decimal places. Read the number you have written.

8. Write seven hundred seventy-two million, six hundred two thousand, eight hundred eight and two hundred one millionths.

9. Read 303,000; 300.003; .303.

10. Which term in multiplication is always an abstract number?

11. Multiply by 100: 36; 1.01; .0236; 11; 7.5.

Multiply:

12.	13.	14.	15.
576,709	680,936	891,628	878,654
80,907	75,080	87,098	48,576

16. When is the result in division a concrete number? When is it an abstract number?

17. Divide by 10: 24; 107.1; 4.006; 26.02; 470.

18. What must 6,140,037 be multiplied by to make 497,398,257,333?

19. How many times can 27,418 be subtracted from 4,580,410,710?

Review Lessons 7 to 11

1. What are factors? What is factoring?

2. What is a prime number? Write five prime numbers.

3. What is a concrete number? Write five concrete numbers.

4. What is an odd number? What is an even number?

5. What is the only even prime number? Why can there be no others?

6. Name five numbers that are both odd and prime.

Find the prime factors of:

7. 126 8. 325 9. 243 10. 1184 11. 1024

12. Find the greatest common divisor of 108, 270, 810.

13. Find the least common multiple of 48, 72, 144.

14. Write all the divisors of 360.

15. What is a fraction?

16. Name the terms of the fraction $\frac{5}{8}$, and tell what each shows us.

17. Give an illustration and the definition of an improper fraction.

18. What is a mixed number? Give an illustration.

19. What do you mean by reduction of fractions?

20. How do you reduce a fraction to its lowest terms?

21. Reduce to lowest terms: *a*. $\frac{775}{950}$. *b*. $\frac{94}{141}$. *c*. $\frac{836}{924}$.

22. Reduce $\frac{2}{3}$ to 36ths. Reduce $\frac{11}{24}$ to 144ths.

23. What change is made in the value of a fraction when:

a. The numerator is multiplied by an integer?
b. The numerator is divided by an integer?
c. The denominator is multiplied by an integer?
d. The denominator is divided by an integer?
e. Both terms are multiplied by an integer?
f. Both terms are divided by an integer?

Review Lessons 12 to 15

1. What must be done with such fractions as $\frac{4}{9}$ and $\frac{3}{7}$ before they can be added? Give their sum.

2. How do you make fractions similar?

3. *a.* Multiply 105 by $\frac{5}{21}$. *b.* Multiply 32 by $\frac{2}{3}$.

4. *a.* Multiply $2\frac{7}{34}$ by 117. *b.* Multiply $\frac{9}{17}$ by 3.

5. How do you multiply a fraction by a fraction?

6. Multiply $85\frac{3}{4}$ by $28\frac{1}{5}$.

7. *a.* Divide $\frac{68}{81}$ by 17. *b.* $\frac{7}{12}$ by 4. Do you use the same method for each of these examples? Explain each example.

8. *a.* Divide 12 by $\frac{5}{6}$. *b.* Divide 8 by $\frac{2}{5}$.

9. Divide $\$224\frac{1}{4}$ by $3\frac{1}{4}$.

10. Divide $3\frac{1}{7}$ by $2\frac{1}{5}$ by two methods. *a.* Make them similar before dividing. *b.* Invert the divisor and proceed as in multiplication.

11. What is a complex fraction? How are complex fractions simplified?

12. Simplify $\dfrac{\frac{4}{7} \times 2\frac{4}{5}}{\frac{4}{11} \text{ of } 2\frac{1}{5}}$.

13. What is a decimal fraction? Write the denominator of a decimal of nine places.

14. .256. Multiply and divide this decimal by 100 by moving the decimal point.

15. Multiply 247.4 by .015.

16. Divide 15.18 by 4.6.

17. What change should you make in the positions of the decimal points before dividing?

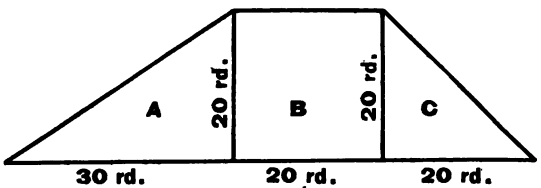
18. Divide eighty-three and seventy-five hundredths by one hundred twenty-five ten-thousandths; to the quotient add sixty-eight and six hundred twenty-five thousandths, and multiply the sum by three and two-tenths.

19. From one take five ten-millionths.

Review Lessons 16 to 22

1. How do you find the area of a square or a rectangle?

2. How do you find the length of a rectangle when you know its width and area?



3. This diagram represents a farm divided into three fields. Find the area in acres of each field and of the entire farm.

4. Measure by pacing some lot near the school and estimate its area in acres or parts of an acre.

5. A room is 17 ft. long, 15 ft. 6 in. wide, and 10 ft. high. There are 3 windows, 6 ft. by 3 ft. 6 in., and 2 doors, 8 ft. by 3 ft. 6 in. Find the cost of plastering it at 30¢ a square yard.

6. What is an angle? How are angles measured?

7. Draw a right angle. It is an angle of —— degrees.

8. What is a quadrilateral? Name six different quadrilaterals.

9. How many handkerchiefs 12 in. square can be made from a piece of linen 1 yd. wide and 4.5 yd. long?

10. Give a rule for finding the area of a trapezoid.

11. A field in the form of a trapezoid contains 104 sq. yd. The altitude is 18 ft. and one of the parallel sides is 36 ft. Find the other parallel side.

12. How do you find the area of a circle, when the radius is given?

13. Find the area of a circle whose circumference is 188.496 ft.

Review Lessons 23 to 30

1. Give the dimensions of a board foot.

2. A field is 240 ft. by 160 ft. The posts are placed 8 ft. apart, how many will it take for a fence round the field? Each post is 8 ft. high and 5 in. square, and there are 4 rows of fence boards, each 24 ft. long, 6 in. wide, and 1 in. thick. How many feet of lumber will it take for the fence?

3. Find the cost of a carpet, $\frac{3}{4}$ yd. wide, at $87\frac{1}{2}¢$ a yard, for a room $21' \times 18'$. The breadths run lengthwise, and there is a loss of 4 in. on each breadth for matching.

4. Find the cost of papering a room 13 ft. long, 10 ft. wide, and 11 ft. high. There are 2 doors and 2 windows, each $3\frac{1}{2}$ ft. wide. The paper costs $33¢$ a roll and the paper hanger charges $15¢$ a roll for putting it on.

5. State the three problems or cases in percentage.

6. A and B each invest \$6000 in business. At the end of a year A has gained 15% and B has lost $4\frac{1}{2}$%. How much has each then?

7. If a man's income is \$1800 and his expenses \$1356, what per cent of his income can he save?

8. A boy earned \$15 a month, which was 30% of what his father earned. How much did they both earn?

9. Three men A, B, and C, form a partnership. A puts in 44% of the capital, B puts in 25% as much as A, and C puts in the remainder. If they lose \$10,500 by fire, what is each man's share of the loss?

10. A man's salary is \$2500 a year. If he pays \$37.50 a month for rent, what per cent of his income does he pay for rent?

11. What is interest? What is the principal?

12. Write a promissory note. Name the maker and the payee.

13. What is the interest on \$1 for 1 yr. at 6%?

14. What is the interest on \$800 for 3 yr. 6 mo. at 5%?

Review Lessons 31 to 37.

1. How do you find the interest on any sum of money for 2 mo. or 60 days at 6%? For 6 days?

2. Find the interest on \$500 for 18 days at 6%. Find the interest on the same sum for 20 days at 6%.

3. Find the interest on \$825 for 2 yr. 11 mo. 5 d. at 4%.

4. Find the interest on \$287.45 from Nov. 8, 1910, to June 9, 1912, at 5%. Subtract dates by both methods. Are the two results the same?

5. Find the amount of \$1080 from Oct. 27, 1910, to Jan. 3, 1913, at 6%.

6. Find the cost of 4 bags of coffee of 48 lb. each at 25¢ a pound.

7. A woman paid 56 cents for 12 oranges and 10 apples. If the oranges cost 3 cents each, what did each apple cost?

8. How many cubic feet do you allow for one bushel of wheat? How many for one bushel of potatoes?

9. A bin is 13 ft. 6 in. long, 8 ft. wide, and 6 ft. deep. How many bushels of potatoes will the bin hold?

10. A bin $14\frac{1}{2}$ ft. long, and 8 ft. wide, holds 464 bu. of grain. How wide is the bin?

11. How do you find the entire surface of a cylinder when you know its diameter and height?

12. What do you mean by the convex surface of a cylinder?

13. Find the entire surface of a cylinder whose circumference is 37.6992 in. and height 18 in.

14. How do you find the approximate and the exact number of gallons in a cistern?

15. Find the approximate and exact number of gallons in a cistern 9 ft. in diameter, and 12 ft. in height.

16. Find the cost of the cellar wall of a house at \$1.75 a cubic yard, exact measurement, if the house measures 60 ft. by 45 ft., and the wall is 8 ft. high by $1\frac{1}{2}$ ft. thick.

Review Lessons 38 to 44.

1. What is the square of 7? The square of 207?

2. What is the cube of 4? The cube of 109?

3. What do you mean by the square of a number?

4. Use mason's method of measurement and find the cost at \$5.25 a thousand for bricks for a building 45 ft. long, 33 ft. wide, 22 ft. high. The walls are $1\frac{1}{2}$ ft. thick. There are 6 windows 7 ft. by 3 ft, and 4 doors 4 ft. by $8\frac{1}{2}$ ft.

5. How many $1\frac{1}{2}$-in. cubes can be placed in a cubical box whose length is 18 in?

6. What does per cent mean?

7. *a*. What is $12\frac{1}{2}\%$ of \$24? *b*. \$3 is $12\frac{1}{2}\%$ of what? *c*. \$3 is what per cent of \$24?

8. State a rule for finding the rate when the base and percentage are known.

9. If you buy oranges at 30¢ a dozen and sell them at \$2.80 a hundred, what will be the gain per cent?

10. By selling land at \$90 an acre a man lost 25%. How much did the land cost? The man wanted to gain 40%. At what price then should he have sold the land?

11. When the cost and gain per cent are given, what two things can be found?

12. When the cost and selling price are given, what can be found?

13. A shopkeeper marked his goods at 25% above cost. He deducted 20% of the amount for cash. What per cent did he make?

14. If an article is bought at 25% less than its value and sold at 25% more than its value, what is the gain per cent?

15. A man offered for sale a piece of land that cost him \$660 so as to gain 40%. If he gave a discount of $16\frac{2}{3}\%$, how much did he receive for the land?

16. What is 138% of \$64.50?

Review Lessons 45 to 51.

1. What is insurance?

2. What is the sum paid for insurance called?

3. What is the written agreement between the company and the person insured called?

4. Find the cost of insuring some goods valued at \$4685, if the risk was taken at $1\frac{1}{4}\%$ on $\frac{3}{5}$ of the value.

5. If a man pays \$468 to insure property worth \$10,400, what is the rate?

6. A man paid \$50 for insuring property worth \$15,000 at the rate of 50¢ on \$100. What part of the value of the house was insured?

7. What is commission?

8. How do you find the net proceeds when the selling price of goods and the rate of commission are given?

9. A merchant bought 1200 bbl. of apples at \$2.40 a barrel. He paid 20¢ a barrel for freight and 5¢ a barrel for storage. He sold all the apples at \$3.20 a barrel. What was his entire gain if he paid 1% commission for buying and the same for selling?

10. A broker sold some goods that cost \$4800 at a profit of 6% and charged 5% on the amount received as commission. How much profit did the owner of the goods receive?

11. Find an agent's per cent of commission when he received \$340.20 on a sale, the net proceeds of which were \$9,379.80.

12. What is the list price of goods? The net price?

13. What is the difference on a bill of \$1275 between a discount of 40% and a discount of 30% and 10%?

14. What per cent is gained by selling articles at 21¢ each that cost \$3.36 a dozen less a discount of 25% and $14\frac{2}{7}\%$?

15. What is the marked price of goods for which \$1500 were paid after a discount of $16\frac{2}{3}\%$ had been given?

Review Lessons 58 to 60.

1. If both members of an equation are multiplied by the same number, is the equality of the equation changed?

2. If x represents the price of a yard of cloth, how should you represent the price of 5 yards?

3. If $5x = 20$, what does x equal?

4. How many square yards are there in a ceiling x yards long and y yards wide?

5. If $7x - 4 = 17$, what does x equal?

6. The sum of two numbers is 234, and the larger number is 8 times the smaller. Find the larger number.

7. A and B are 64 miles apart. They travel toward each other until they meet. If A travels 3 times as many miles as B, how far will each travel?

Find the value of x in the following:

8. $2x - 4 = 8$

9. $5x + 3 = 28$

10. $\frac{x}{3} = 9$

11. $6x - 3 = 33$

12. $\frac{x}{2} + 7 = 21$

13. $\frac{x}{5} - 2 = 3$

14. The length of a rectangle is 3 times its width and the perimeter is 288 feet. Find the area of the rectangle.

15. A has 4 times as many cows as B, but if A should sell 6 to B, they would then have the same number. How many cows has each man?

16. A is 2 times as old as B and 3 years older than C. The sum of their ages is 72 years. How old is A?

17. A father and son earn \$80 a month. If the son's wages were doubled he would receive as much as his father. How much does each receive?

18. The sum of the ages of father, mother, and son is 108 years. The mother is 3 times as old as the son, and 3 yr. younger than the father. Find the mother's age.

Review Lessons 61 to 64.

1. What is ratio?

2. Compare 5 with 15. Express this ratio in three ways.

3. How many terms has each ratio? Which is the antecedent? Which is the consequent?

4. Divide \$234 into two parts in the ratio of 4 to 5.

5. How long will it take 144 men to do a piece of work that 36 men can do in 16 days?

What is the ratio of:

6. $\frac{3}{8}$ to $\frac{3}{4}$?
7. $\frac{3}{8}$ to $\frac{1}{4}$?
8. 5 yd. to 9 ft?
9. $\frac{2}{3}$ to $\frac{1}{9}$?
10. $4\frac{1}{2}$ to $22\frac{1}{2}$?
11. \$20 to 50 cents?
12. $\frac{2}{9}$ to $\frac{1}{3}$?
13. $23\frac{1}{3}$ to $3\frac{1}{3}$?
14. 2 hr. to 10 min?

15. What is proportion?

16. $15 : 5 = 12 : 3$. Is this a correct proportion? Prove your answer in two ways.

17. How many terms has a proportion? What is true of the product of the extremes and of the means?

Find the missing term in the following:

18. $16 : 8 = 7 : x$
19. $x : 10 = 18 : 12$
20. $9 : x = 3 : 4$
21. $2 : 3 = x : 6$
22. $10 : x = 12 : 6$
23. $4 : 16 = 7 : x$
24. $x : 4 = 12 : 3$
25. $x : 8 = 6 : 3$
26. $7 : x = 10 : 15$

27. How many bushels of potatoes will cost \$12.76, when 5 bu. 2 pk. cost \$4.84?

28. A and B entered into partnership. A furnished \$6000 of the capital and B \$4000. At the end of the year their profits were \$4800. Find each one's share.

29. Divide \$2700 among three partners so that their shares shall be in the proportion of 4, 5, and 6.

30. A, B, and C engaged in business with a joint capital of \$12,000. A put in \$5000, B, \$3000, and C, the remainder. Their profits were \$4800. Find the share of each.

Review Lessons 72 to 77.

1. Six times the difference between a certain number and 7 equals 12. What is the number?

2. Maine lacks 220 sq. mi. of being large enough to make 4 states the size of Massachusetts. How large is Massachusetts, if Maine contains 33,260 square miles?

3. A tree 75 ft. high was broken by the wind so that the part standing was in proportion to the part broken off as 3 to 2. How long was each part?

4. Without measuring mark off a square rod on the schoolroom floor.

5. Name some object that is about 40 rd. distant from the schoolhouse.

6. A man in an aeroplane estimated that he was 3500 ft. from the ground. What part of a mile is that?

7. How much U. S. money will it take to pay a debt in London of £85 8s.?

8. How many pounds and shillings can be bought with $194.66?

9. Some goods were invoiced at 180 lira. Find their value in U. S. money.

10. Give the rule for finding one dimension of a rectangle, when the area and the other dimension are given.

11. What must be the height of a triangle that contains 1125 sq. ft. and whose base is 90 ft. in length.

12. What is the area of a circular table top that has a diameter of 2 ft. 6 in.?

13. How many cubic feet are there in a room 35 ft. by 28 ft. by 11 ft.? How many square feet of surface are there in the room?

14. Find the entire surface of a cylinder whose diameter is 4 ft. and whose altitude is 8 ft. Find the volume of this cylinder.

Review Lessons 80 to 86.

1. What is longitude? Where is the prime meridian?

2. If you travel toward the east will you find earlier or later time?

3. How do you find the difference in time between two places, when you know their difference in longitude?

4. Given the longitude of two places and the time of one place, what can you find? How will you find it?

From the table of longitudes on page 82, *find the difference in time between:*

5. Amsterdam and New Orleans.

6. Berlin and New York.

7. Boston and Paris.

8. Canton and Rome.

9. Chicago and San Francisco.

10. Manila and Washington.

11. When it is noon at the first place mentioned in examples 5, 6, and 7, what time is it at the other place?

12. When it is 10 A.M. at the second place mentioned in examples 8, 9, and 10, what time is it at the other place?

13. A citizen of Chicago does not change the time of his watch when traveling. He went to Boston, Mass., and to San Francisco, Cal. At which place was his watch too fast? How much too fast by solar time and by standard time? How much too slow will it be at the other place?

14. The 180th meridian is called the *date line.* Trace this line on the globe or on a map in your geography. Crossing this line from east to west you must add a day to your reckoning. If you cross it Saturday noon you must call it Sunday noon. If you cross from west to east you must repeat a day.

15. When it is 4 A.M. at Boston, what is the solar time at San Francisco?

Review Lessons 90 to 98.

1. What is compound interest?

2. State the method for finding compound interest on \$500 for 4 years at 4%, compounded semi-annually.

Find the difference between the simple and compound interest of:

3. \$1678 for 2 yr. 5 mo. 19 d. at 6%.

4. \$6745 for 3 yr. 9 mo. 17 d. at 4%.

5. \$1486 for 5 yr. 5 mo. 5 d. at 5%.

6. \$1563 for 5 yr. 3 mo. 21 d. at $4\frac{1}{2}$%.

Using the table find the compound interest of:

7. \$575 for 8 yr. 6 mo., compounded semi-annually at 4% a year.

8. \$1070 for 4 yr. 3 mo., compounded quarterly at 6% a year.

9. \$2040 for 7 yr. 6 mo., compounded semi-annually at 5% a year.

10. What do you mean by the convex surface of a cylinder? The convex surface is sometimes called the lateral surface.

11. How many cubic feet of gas will a tank contain that is 45 ft. in diameter and 30 ft. in height?

12. How many faces has a cube? How many has a rectangular prism? An octagonal prism?

13. Define a straight line.

14. How many straight lines or edges has a crayon box?

15. Draw two intersecting lines. How many angles are formed?

16. Measure the angles in example 15 with your protractor. Find the sum of all the angles.

17. When the hour hand of the clock is at XII, where must the minute hand be to form with the hour hand an angle of 30°?

Review Lessons 102 to 105.

1. Why are taxes necessary?

2. State the difference between a poll-tax and a property tax.

3. Give a good reason why all men do not pay the same amount of tax.

4. What is the difference between real estate and personal property?

5. State the method used for determining how large a tax a man must pay.

6. Given the total tax levy, the number of polls, and the amount of each poll-tax, what can you find? How can you find it?

7. Given the amount of the property tax, and the assessed valuation of the property, what can you find? How can you find it?

8. The assessed valuation of the property of a town is \$2,242,000. The amount needed for special purposes is \$11,210. What is the tax of Mr. Reynolds, whose property is assessed at \$8476?

9. The assessed valuation of a city is \$10,500,000. The money to be raised by taxation is \$147,000. What is the rate?

10. The valuation of the town H is \$2,432,500, and the tax levy is \$48,650. Mr. Smith owns \$150,000 worth of property, assessed at $\frac{2}{3}$ of its value. What is his whole tax?

11. The expenses to be paid for by taxation in a certain village are \$9600. The valuation of the village is \$480,000. If Mr. Davis pays \$170.80 as a tax, for how much is his property assessed?

12. A town whose valuation is \$4,900,000, raises by taxation \$63,210. There are 980 polls, each taxed \$2. What is Mr. Brown's tax, if he owns a farm valued at \$3200, personal property amounting to \$1800, and pays one poll-tax?

Review Lessons 106 to 109.

When $a = 5$, $b = 4$, $c = 6$, and $d = 8$, find the value of:

1. $ac + b$
2. $(a + c) \times (b + d)$
3. $(d - b) + (c - a)$
4. $(a + b \times ab$
5. $2a + 3b - c$
6. $d + 3b - 2c + a$

7. What number increased by 15 and the sum doubled makes 46?

8. George has 22 cents more than Leroy. If he has 3 times as much money as Leroy, how many cents has he?

9. The sum of two numbers is 60 and the greater lacks 3 of being 6 times the smaller. What are the numbers?

10. The difference of two numbers is 7, and the greater is x. What are the numbers?

11. If there are four numbers each equal to $3x$, what is their sum?

12. The sum of two numbers is y, and one of the numbers is 8. What is the other number?

13. If there are s books, each worth x dollars, what is the total cost?

14. Divide 80 cents between two girls, so that one shall have $\frac{2}{3}$ as many as the other.

15. Find two numbers, whose difference is 14, when one is three times the other.

16. Divide \$500 among A, B, and C, so that B and C may each have twice as much as A. How many dollars will each have?

17. A horse and wagon are worth \$300, and the horse is worth 3 times as much as the wagon. What is each worth?

18. A and B went into business together with a cash capital of \$2400. If A put in 4 times as much as B, how much did each invest?

19. The difference of two numbers is 6, and their sum is 24. What are the numbers?

Review Lessons 114 to 119.

1. What is a national bank?

2. State five things that a bank can do to aid in carrying on business.

3. What is a check? Write one.

4. Write a note having the following data: Date, Nov. 3; face, $1050; time, 3 mo.; payee, George W. Hopkins; maker, yourself.

5. If Mr. Hopkins wishes to discount this note at a bank, state what he must do.

6. If the note is presented at the bank Dec. 1, state the four steps necessary to take to find out how much Mr. Hopkins will receive.

7. Define the following terms: Bank discount. Term of discount. Date of maturity. Proceeds.

8. When and how is a note protested?

9. A 2 months' note for $850 was dated Feb. 5 and discounted Feb. 23, at 6%. Find the proceeds.

10. A merchant bought some goods for $2450, and sold them at an advance of 12%, receiving in payment a 60 days' note for the amount. If the merchant discounted the note immediately at 6%, find his gain.

11. Find the bank discount and proceeds of a 60 days' note of $1500, dated Jan. 5, and discounted Feb. 1, at 6%.

12. Write a check payable to the order of your teacher. On the back write what your teacher would write to make the check payable to Charles O. White.

13. Write a promissory note for $500, making yourself the payer and a classmate the payee. On the back write the words necessary to make the note payable to your teacher.

14. What is the meaning of negotiable? What words in a note make it negotiable?

15. Write a demand, negotiable note.

1. Two towns are 150 miles apart. If the railway fare is \$3.00, what is the rate a mile?

2. Find the cost of $1\frac{1}{2}$ bu. of potatoes at 15¢ a half-peck.

Give results:

3. $8100 \div 100$	4. $66{,}000 \div 22{,}000$	5. 13×300
6. $4634 \div 100$	7. $39{,}000 \div 13{,}000$	8. 2.4×100
9. $40.25 \div 100$	10. $56{,}000 \div 12{,}000$	11. $.12 \times 200$

12. At 32¢ a pound, find the cost of 2 lb. 5 oz. of butter.

13. If 3 men can do a piece of work in 4 days, how long will it take 24 men to do it?

14. What is the effect on the value of a decimal of moving the decimal point two places to the right?

15. If the denominator of a fraction is divided by 3, what is the effect upon the value of the fraction?

16. If a cipher is added at the right of a decimal what effect has it on the value of the decimal?

17. Reduce $\frac{15}{25}$ to a decimal fraction.

18. How many board feet are there in 12 planks, each 14′ long, 6″ wide, and 3″ thick?

19. A room is $\frac{3}{5}$ as wide as it is long, and its length is 20 ft. Find the square feet in the floor.

20. How many days are there from May 18 to July 4?

21. What is the perimeter of a triangle whose sides are $2\frac{1}{2}$ ft., $4\frac{3}{4}$ ft., and $3\frac{1}{4}$ ft.?

22. It requires 64 rd. of fence to inclose a square field. How long is each side of the field?

23. In a school of 300 pupils, 15 are absent. Find the per cent of attendance.

24. How many $\frac{1}{2}$-inch cubes will build a 2-inch cube?

25. A father is $12x$ years old. A son is $\frac{1}{2}$ as old as his father, and a daughter is $\frac{1}{2}$ as old as the son. How old is the daughter?

1. The sum of two numbers is 24, and one of them is twice as large as the other. What are the numbers?

2. Find the interest on \$1248 from March 4, 1910, to Aug. 12, 1913, at 5%.

3. The area of the gable end of a house is 35 sq. yd. If the house is 42 ft. wide, find the height of the gable.

4. A schoolhouse is insured for \$27,000, which is $\frac{3}{4}$ of its value. If the premium was \$594, at what rate was the house insured? What was the value of the house?

5. The valuation of a town is \$175,600. There are 276 polls, each assessed \$1. The town wishes to raise \$2910. What tax must a man pay who owns a house valued at \$3000?

6. Find the number of gallons of water in a well $4\frac{1}{2}$ ft. in diameter, if the water is 9 ft. deep.

7. A man bought a horse Oct. 3, 1910, for \$186, and gave in payment his note at 6%. On June 13, 1911, he sold the horse for \$195, and paid his note in full. How much did he gain?

8. John Jones paid Amos White of Trenton, N. J., on Sept. 1, 1910, \$112.24, amount due for meat. Write the receipt in full.

9. A gentleman bequeathed $\frac{1}{3}$ of his estate to his wife, $\frac{1}{4}$ of the remainder to his eldest son, and $\frac{1}{5}$ of what then remained to his two daughters, each of whom received \$342. What was the value of the estate?

10. Change 616,346 seconds to minutes, hours, and days.

Find the approximate cost mentally, then test your work:

11. 15 lb. @ 15¢
12. $13\frac{3}{4}$ lb. @ 16¢
13. $28\frac{3}{4}$ cd. @ \$8.
14. $22\frac{1}{4}$ A. @ \$30.
15. $24\frac{1}{2}$ bu. @ 75¢
16. $14\frac{1}{2}$ gal. @ 28¢
17. $18\frac{1}{2}$ doz. @ 24¢
18. 88 yd. @ 15¢
19. 98 cd. @ \$$4\frac{1}{2}$.
20. 110 T. @ \$6.50
21. 76 yd. @ \$1.25
22. 25 pk. @ 25¢.

1. Without changing to cubic feet, find the number of cords of wood in a pile 16 ft. long, 4 ft. wide, and 8 ft. high. In a pile 24 ft. long, 4 ft. wide, and 4 ft. high.

2. A room is 9 ft. square and 10 ft. high. What will it cost to plaster the walls at 25¢ a square yard?

3. Divide the number 45 into two parts, which shall be to each other as 7 to 2.

4. Two men hired a pasture for $40. One pastured 5 horses and the other 3 horses. What ought each to pay?

5. Two boys have 41 marbles. If one has 5 marbles more than the other, how many marbles has each?

6. What will it cost to insure a house for $4200 at $2\frac{1}{2}\%$?

7. What number must be subtracted from $\frac{1}{4}$ to leave .15?

8. A, B, and C, form a partnership: A puts in $3000; B, $2000; and C, $4000; How should a gain of $3600 be divided among them?

9. Find the interest on $3000 for 20 days at 6%.

10. $\frac{1}{4}$ of a number exceeds $\frac{1}{5}$ of it by 9. What is the number?

11. An article was sold for $56 at a loss of 20%. Find the cost and the loss.

12. If a man owns $6000, what tax must he pay, if the rate is $1\frac{1}{2}\%$?

13. If a man insures his life for $4000 at $2\frac{1}{2}\%$ per annum, what will be his annual premium?

14. A man paid $10.50 for having his house insured at $\frac{5}{8}\%$. For what amount was the house insured?

15. If you bought a bill of goods amounting to $25, with a trade discount of 20% and 5% off for cash, what would be the net amount of the bill?

16. When you know the list price of some goods and the two rates of discount in a series, how do you find the net price?

1. Using a scale of $\frac{1}{8}$ in. to a rod, draw a plan of a farm, whose boundary runs as follows: From A 30 rd. east to B; from B, 12 rd. south to C; from C, 24 rd. east to D; from D, 36 rd. south to E; from E, 54 rd. west to F; from F, north to A. Find the whole area of the farm and the length of the boundary fence.

2. A car load of peaches was bought at 80¢ a basket and sold at a loss of $12\frac{1}{2}\%$. If the loss was \$43.20, how many baskets were in the car?

3. After taking out his commission of 4%, an agent remitted to his employer \$1900.80, the amount due him on wheat sold at \$.60 a bushel. How many bushels of wheat were sold?

4. The cellar of a house is 42 ft. long, 33 ft. wide, and 8 ft. deep. Find the cost of digging it at $37\frac{1}{2}$¢ a cubic yard. If the wall is $1\frac{1}{2}$ ft. thick, how many cubic feet are there in the wall? Find the answer both by exact measurement and by mason's measurement.

5. A circular field is 60 rd. in diameter. How many acres does it contain?

6. How many yards of carpeting $\frac{3}{4}$ yd. wide will carpet a room $18\frac{2}{3}$ ft. long and $16\frac{1}{3}$ ft. wide, if the breadths run lengthwise and there is a loss of 7 in. on each breadth for matching?

7. How many bushels of wheat will fill a bin 6 ft. long, $3\frac{1}{2}$ ft. wide, and 3 ft. 8 in. deep?

8. The amount of tax to be assessed in a certain city is \$14,382. The taxable property is \$2,850,800 and the number of polls, each assessed \$1.50, is 1080. What is the rate of taxation?

9. Divide \$4.08 among 4 boys in the proportion of 3, 5, 7, and 9. How many cents will each boy receive?

10. Find the inner and outer circumference of a walk $6\frac{1}{2}$ ft. wide, running round a circular grass plot that measures 90 ft. in diameter. Find the area of the walk.

